SCIENTIFIC AMERICAN

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STEAM HAND CAR--MINIATURE RAILROAD TRAIN.

A new steam hand car has recently been designed and constructed by Mr. Jay Noble, master mechanic for M. M. Buck & Co., of St. Louis, Mo., which is excellently adapted for the use of division superintendents, road masters, and others whose duty requires them to make frequent inspection of railway lines. The machine, as shown in the engraving, resembles an ordinary hand car, except that the propelling power is steam and not muscle. The floor is about 10 inches from the ground, and is beneath instead of above the axles. The boiler, which is about 3½ feet in hight with a diameter of 18 inches, is placed in the center of the car, while the cylinder, which is horizontal, is at the right hand side and near the floor. The cylinder is 3½x6 inches, and the boiler is intended to carry a pressure of 140 lbs. of steam. The body of the vehicle rests on rubber springs and rides very easily without lateral motion.

Seats are arranged in front and rear, of sufficient size to accommodate six persons. The water tank occupies a space under the back seat and holds about a barrel of water, which is sufficient to run the car 40 miles. On the left of the boiler, the coal pan is arranged in a space about 2 feet wide, and carries all the fuel necessary for a day's run.

On a recent trial trip, the run from St. Louis to Carondelet, a distance of seven miles, was made in fifteen minutes. The general design of the car, which is quite tasteful and at the same time well adapted to withstand severe usage, is plainly represented in our illustration. The idea developed in this miniature steam car might be adapted to other purposes than the one designated. We should think every railroad company would find such a steam car useful for various purposes.

The inventor states that under ordinary circumstances the cost of fuel will not exceed 75 cents per day. The general arrangement is excellent and reflects much credit on the designer.

STEAM HAND CAR.

Professor Bottger's Experiments with the Radiometer.

The much-talked-of radiometer, which Professor Crookes believes to be set in motion by the mechanical action of light, has fallen into the hands of that skillful experimenter, Professor Rudolph Böttger, editor of the *Polytechnisches Notizblatt*, at Frankfort on Main. In a communication to the Berlin Chemical Society, he described some of these interesting experiments. The radiometer employed by Dr. Böttger was made by Geissler in Bonn. The plates attached to the revolving arms were made of mica, rendered white by heating, and blackened on one side. This instrument was provided with a leaden foot to cause it to float upright in water.

When this little instrument was exposed to the direct light of the full moon, or to the light of strongly phosphorescent Geissler tubes which have been illuminated by burning magnesium wire, the arms do not show the slightest motion. If the apparatus is placed at a distance of 10 inches from a bright luminous gas flame, and a clear plate of alum 0·2 inch thick fastened in the center of a pasteboard screen be interposed between them at the same hight, there will be but a very slight revolution of the arms, showing that the easier radiation of heat by the blackened side of the mica plates than by the bright side, in a space which is not an absolute vacuum, although ever so rarefied. Dr. Bottger compares it to the Segner water wheel.

If the radiometer is taken into a room where the temperature is about 15° C. (59° Fah.) and placed near a luminous gas flame, the arms revolve from right to left, that is, with the bright side of the mica in front. While the arms were still in motion, this little instrument, with its leaden foot, was placed in a glass cylinder filled with water at 45° C. (113° Fah.) so that it was entirely immersed; the motion of the wheel was retarded, it stopped, then began to turn in an opposite direction, namely, from left to right, the blackened side of the mica being in front. In a short time, when the glass bulb and its contents had acquired the temperature of the surrounding water, the wheel came to rest.

Dr. Bottger repeated these experiments with a radiometer made by Mollenkopf of Stuttgart, and with somewhat different results. When this instrument was placed in warm water while in motion, it did not change its direction of revolution like that from Bonn.

If both instruments are set in motion by a feeble light and ether allowed to drop on them, causing quite a decrease in temperature, no retardation was observed in the apparatus from Stuttgart, while in that from Bonn the motion of the arms was strikingly slower. The experimenter thinks it probable that this difference in the action of two apparently identical apparatus was due to the vacuum being more perfect in one than in the other.

It would be interesting to make some experiments with an instrument where both sides of the mica or aluminum plates are blackened, also where both are bright. Such an instrument should be motionless when exposed to the action of radiant heat.

The Intercollegiate Boat Race.

The intercollegiate boat races took place at Saratoga, on July 19, and were all won by the Cornell University crews. The University race, in which Cornell, Harvard, Columbia, Union, Wesleyan, and Princeton colleges competed, was gained by Cornell in 17 minutes 1½ seconds—distance three miles. The freshman race, against Harvard only, was won in 17 minutes 23½ seconds, and the single scull race in 13 minutes and 42 seconds. The time is not considered remarkable, but the victory was fairly gained; and coming, as it does, in direct succession to the honors won by Cornell last year, it will secure for the students of that college the highest reputation for athletic culture.

We have already expressed our opinion relative to races of this kind, and need not repeat it here. It may be noted, however, that there were fewer cases of fainting or other signs of physical overwork observable during the races which have just taken place, than appeared last year. As the men were all tried hands at the oar, many having rowed in other trials, their experience then gained, doubtless, prevented any over exertion, a fact indicated by the time made.

Public interest in these races seems to have greatly decreased, the attendance having considerably fallen off this year, and it is considered doubtful whether another large regatta will soon again occur.

An Asbestos Exposition.

An interesting exposition of asbestos has recently been held at the Simonetti Palace in Rome, the material being exhibited under all forms, from the crude state as mined to its highest industrial preparations. The *Gaceta Industrial* states that there were samples of thread made from the mineral which were stronger than the best English cotton; cloth, from coarse bagging to a fabric as fine as linen; paper for writing, printing, and sheathing buildings, and pasteboard. The asbestos paper is made at Tivoli, Italy, and costs about 40 cents per lb. It is especially useful for important documents which it is desired to preserve from fire. To test the fireproof qualities of the pasteboard, a case made therefrom was filled with ordinary paper, another case of pasteboard, not containing asbestos but otherwise exactly similar, was likewise filled, and both were thrown into a fire. In the space of five minutes the unprepared pasteboard box and its contents were wholly consumed, while to that period the asbestos box remained uninjured. Nearly all the asbestos mined in Italy finds its market in the United States.

Naval Items.

On July 19, Passed Assistant Engineer C. J. Habighorst was ordered to the Powhattan on August 1 next, and ordered to report to the Superintendent of the Naval Academy at Annapolis, Md., on August 20, for duty as an instructor in the department of steam engineering.

The Board for the examination of candidates for admission and promotion in the engineer corps, lately in session at the navy yard, League Island, has adjourned until September 1.

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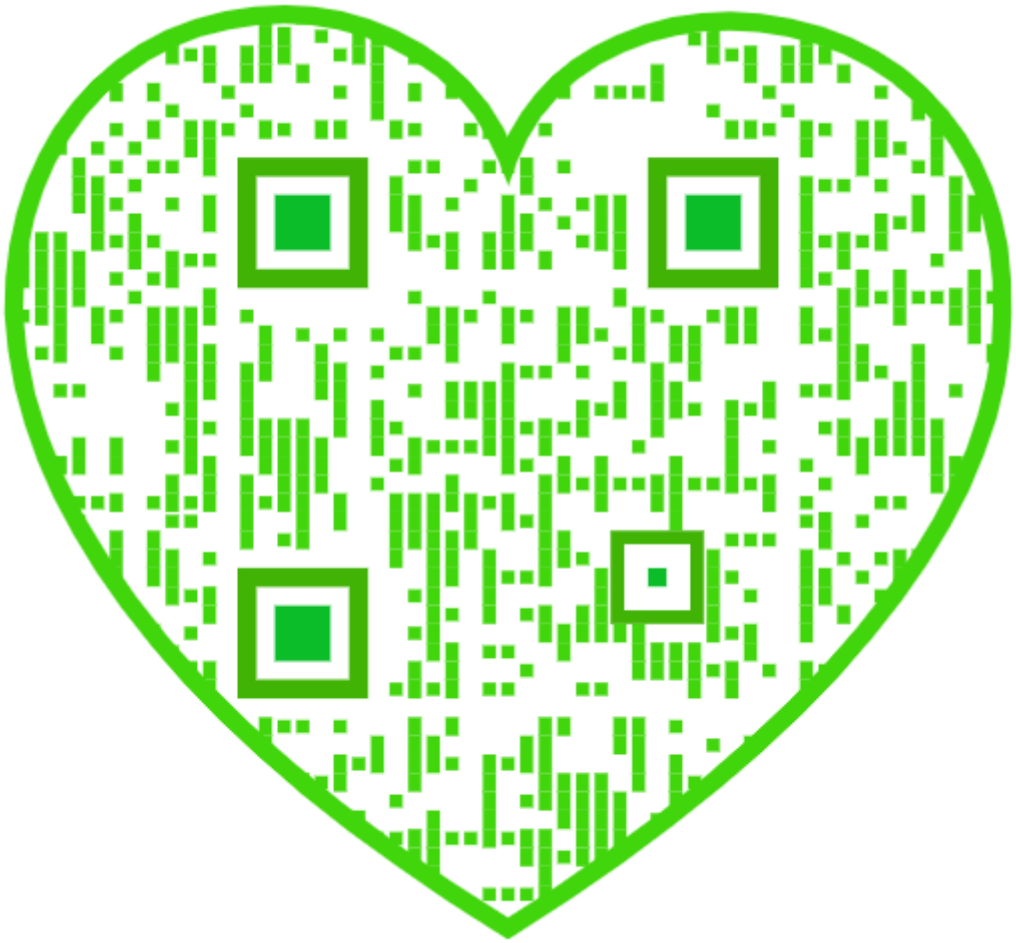

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WORKMEN AND THEIR INSTRUCTORS.

That there is a gulf between the purely practical man and his teacher the theorist is one of the misfortunes of our day; and that there exists between them a lack of appreciation, one of the other, is painfully apparent to anybody who comes into contact with them both. Neither will allow that a goodly store of the knowledge and experience possessed by the other would not be a decisive benefit to him. But the theorist well knows that the efforts he may make in purely practical pursuits, however successful from a mechanical point of view, are sure to be, comparatively, financial failures: or, in other words, the expert workman must as a rule look for financial success in the same degree as he abandons his practice and enters the domain of theory. It is a very easy matter to quote examples of great men, who, like Galileo, threw their whole life and soul into their studies, and, rising to the pinnacle of fame, made the world their debtors; but how would it have been if Galileo had known that, so soon as he had advanced to a certain hight in knowledge of his beloved science, he must, to advance any further, abandon it and enter an arena new to him? And this is the precise position of the expert workman. The day has gone by when fame alone is a sufficient reward for labor or skill. Diogenes would in our day find his tub kicked into the street, and himself under lock and key as a vagrant. Galileo would be sneered at as a visionary; while ordinary good breeding prohibits enthusiasm, which is now-a-days considered an attribute of youth or inexperience. The ordinary mechanic of to day is a child of to-day, with its ruling passions well developed in him. Among those passions a desire, a greed almost, for money is not the least; and he naturally takes the readiest course to obtain it. Now what is that course? Is it to become a skillful, practical mechanic? By no means: it is to learn the most commonly known method of doing work, the principles, so far as generally known, governing the manipulation or construction of the work or machine, as the case may be. In fact, since to take charge of others is his aim, he only exerts himself to gain sufficient knowledge to enable him to do so. The shop manipulation, knowledge of business, force of character, mathematics, mechanical drawing, etc., necessary to the attainment of his object, he strives to master. The better his education, the more sure he is to rise; so that a really intelligent and well educated man, with ordinary exertion, is rarely found in the working mechanic, even if he has had ten or twelve years of experience. As he drifts away from his position as a workman, he drifts away from its elements; as a working foreman, his studies are less practically manipulative; he has spent perhaps five years at his business, and during that time his attention has been divided between two things, one to become as expert a workman as he can, the other to gain the extra knowledge necessary to bring him into notice and make him capable of managing and directing other men; and so soon as he makes the first step of advancement, his progress in acquiring manipulative skill is cut short. This is of course unavoidable; but it leads to consequences, as we shall presently see, that are not unavoidable, but are on the other hand very deplorable. As a superintendent he enters a new field, in which his purely practical knowledge is of comparatively little value to him; yet he is the representative head and front of the purely practical man, and will often aspire to a superior knowledge of even the practical workmanship. The expert workman, who has spent from 12 to 20 years in the workshop, and who, in addition to being naturally and mechanically skillful, has made the work his study, looks around him in the workshop and sees here a machine running too slow, there a workman who would do double his quantity of work if a little of that inside information, which old and skillful mechanics always possess, were imparted to him. Then he thinks how much more work could be got out of the same amount of men and machinery if they only knew what he knows. He smiles to himself, and dismisses the subject from his mind, feeling that in his sphere of knowledge he stands alone: conscious, perhaps, that he could not fill the position of even a foreman, but conscious at the same time that money is being thrown away, and that, so far as the practical workmanship is concerned, those above him do not know their business, at least not as he knows it. He has not only no enthusiasm, therefore, for those above him, but he has innately a poor opinion of them, and inwardly rebels at his own position. There is his field of usefulness a comparative waste; and his mechanical advancement is impossible, because: Here we may pause and repeat a woman's reason: Because. The truth is that he is not supposed to know anything, and for the simple reason that his judges were never in his element. They might have attained to his knowledge, but they left his field of study and do not know that it takes twenty years to become, on light work only, an expert workman at the lathe, machine, and vise.

What are the chances of combining in one man, first, a mechanic sufficiently expert as a workman to stand legitimately as an authority and teacher to a large shop of workmen, secondly, one with sufficient judgment and command to govern them, and thirdly, one who shall also be an expert theoretical engineer? Let us see. Out of every 100 turners, there will be found not more than 2 of the highest order of efficiency. Out of 100 workmen, not more than 5 at most are capable of taking charge of men. Out of 100 men, not more than 5 are expert at the planer as well as the lathe; then again, not more than 5 in 100 are capable of explaining even what they do know. Out of every 100, there may be also 5 who have a knowledge af mathematics sufficient to make the calculations absolutely necessary to their work, if required to do so; then, perhaps, 5 per cent of workmen can make a decent mechanical drawing. But, on the other hand, 5 per cent are unsteady, 5 per cent are comparatively untutored, and so on; so that the chance of finding the above-mentioned combination in one man is somewhat small. It becomes apparent, then, that as a rule it is not the most useful workmen who are promoted into better positions, for the reason that the requisites to fill those positions include requirements other than manipulative skill: which requirements in the aggregate give practical expertness a comparatively small place in the general qualification of the foreman. Thus it happens that we may find a hundred cases wherein the workmen of a shop have a profound respect for some particularly expert workman, while only one case in which such respect is entertained by the workmen for the foreman of a shop; and it generally happens that, where such respect does exist, it is a bar to the advancement of the expert for the reason of the impossibility of his assuming control over men with whom his relations have been so intimate. That this should be so is not at all unreasonable, because his superiority is brought before them almost every day of their lives. He is to them, to a certain extent, a mystery in and upon a matter in which they themselves are, to themselves, masters; for of what does the ordinary mechanic assume to know more than of the trade at which he spends his days from morning till night, year in and year out? When a mechanic exerts himself to his utmost, when he puts forth the whole strength of his muscles as well as of his mind, when he calls to his aid all his experience, all his knowledge, all his determination, and all his strength, and then fails, and meets another who, with the same tools and under the same conditions, can perform vastly more and superior work, he knows that this capability is not due to either advantages of brute force or school education, but to some indefinable qualification known as skill. This seems to him to set education, perseverance, and strength at defiance; then respect creeps in, and the skill becomes a shrine, and its possessor an idol. An example of this kind occurs to our mind. A tall strong man, with brawny arms and with muscles hard and well developed, was engaged in filing up some parallel bars; he had the work by contract, and had filed up scores of them. He was an experienced mechanic, and had gotten himself into trouble for working so quickly as to get those men who chanced to have the same work to do by day's work into disrepute, because of their inability to compete with them, even in cost, let alone in time. On one occasion, however, a somewhat delicate looking workman, who worked near, challenged him to file up a bar in competition with himself (the challenger). The gauntlet thus thrown down was accepted, and for three hours the contest raged. Each was allowed new rough, second cut, and smooth files; and the excitement among the other workmen, of whom there were eight, ranged along the side of the same bench, was at a high pitch. The challenger finished his work first, and it was examined by his opponent and pronounced well executed; but a repetition of the trial of skill was requested, and made, with the same result. It was in winter; the workshop had no heating apparatus of any kind, and, though it was freezing, the contestants were in their shirt sleeves, and yet were perspiring. Then the challenger was thus addressed by his opponent, who had ceased working and had been engaged a few moments in apparent deep thought: "I cannot understand it; I can only accept and respect it. I have nearly twice your strength, and have had ten years more experience. I can look clear over your head, and can ho'd you with one hand; and yet I am beaten, beaten at my own job too; and worse than all, I cannot for the life of me tell how it was done." He surveyed himself, held out his strong arms and looked at them, then shrugged his shoulders and went on with his work. He might look within himself, and find, so far as his understanding was capable of judging, every element of superiority, except in that mysterious, intangible, indescribable qualification known to him under the cognomen of skill, which the closest scrutiny of the most experienced eye cannot detect save in its results.

ANCIENT GRECIAN GLASS.

Among the rare objects discovered in ancient Grecian burial places are some curious ones of glass, mostly found in the graves of women. Frequently these consist of vessels with long necks, drinking vessels (without handles and round at the bottom), and of flat and open dishes. All these glass objects appear to have been articles of luxury, and not domestic utensils. According to the recent investigations of Professor Landerers in Athens, this gloss is usually a silicate of soda, sometimes of potassa; but it is always very rich in lead oxide. These wonderful ancient productions often show the most magnificent rainbow colors, with a metallic luster like polished gold and silver, and the material of which they are formed may be split up into very thin layers. That this peculiar appearance is the result of old age, which has produced a change in the material, may be seen in the glass vessels preserved in the Metropolitan Museum of Art, in New York city, which are of still older date, having been procured from the island of Cyprus, by General Di Cesnola. These objects belong to a period of time intermediate between the ancient Egyptian and the Grecian periods; and the coloring operation is the same as that which takes place on the surface of glass panes in windows exposed to continuous changes in moisture and dryness. But it is found in its most complete result when, in the course of centuries, the action of time penetrates the whole mass, forming layer upon layer, shining with the colors of soap bubbles or mother-of-pearl, but with much greater intensity.

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Among the rarely occurring objects are some of a deep green or black brown color, which are called vulcanic glass, and are made of obsidian ; but to these the ancients added oxide of lead in the form of massicot, so as to make the mass more easily fusible.

Colored glasses have also been found in the ancient Grecian burial places ; the yellow colored (which, however, had become almost opaque) contained a silicate of alumina colored with oxide of iron ; probably ocher was used in these, mixed with the pulverized glass before the melting, so that the color was obtained after the fusion. A blue glass, which contained streaks of blue of various shades, contained oxide of copper ; and in producing this effect the ancients used probably the malachite and azurite (both mineral carbonates of copper) or other green or blue colored copper ores, or the so-called *cæruleum*, which in Egypt was made of copper, sand, and salt, and was used to color the cases in which the mummies were preserved. A specimen of white glass. resembling opal, but showing thousands of cracks, was undoubtedly made of milky half opal, which is found in Greece in the island of Mylos,and which was fused to make objects of the peculiarly colored appearance.

These and other modern investigations continue to prove that the so-called lost arts of the ancients, which some persons grossly exaggerate, trying to make it appear that the ancients surpassed the moderns in knowledge and civilization, did not amount to more than laborious attempts to produce a few of the richer objects which modern industry produces with the greatest ease and in the utmost abundance, placing them, for reason of their low price, at the disposal of every industrious man, even of the comparatively poor laborer, who, thanks to the inventive genius of the present day, enjoys comforts which the working man of ancient Greece would never think himself worthy to enjoy.

MECHANICAL VIBRATION AS A SUBSTITUTE FOR ANÆSTHETICS.

The application of anæsthetics in cases of surgical operations is of comparatively recent date. Dr. Morton discovered that the ethers, inhaled to a sufficient extent, produced a general anæsthetic state, during the continuance of which operations, which otherwise would be most painful, might be performed without the knowledge of the patient. The surgeon availing himself of anæsthetics is enabled to perform operations with greater deliberation and with greater precision, not having to contend with the writhing and shrinking of the patient; but certain dangers which accompany general anæsthetics, whatever the agent employed, have induced experiments for producing the effect locally.

For minor operations, surgeons have had recourse to refrigeration produced by a spray of very volatile liquid, or by the application of freezing mixtures. Intense heat induced by a galvanic current has also been employed, and various other agents have been tried with more or less success; but barring this danger, chloroform and ether stand thus far unrivaled. The desirability of an agent that will produce local anæsthesia cannot, however, be questioned.

Dr. Livingston records a remarkable instance of general nervous insensibility, which, although produced by an undesirable agent, proves that the nerves may be thrown into an insensible state by a means quite unlike the ordinary administration of anæsthetics. He says: "I saw the lion just in the act of springing upon me. I was upon a little hight ; he caught my shoulder as he sprang, and we both came to the ground below together. Growling horribly, close to my ear, he shook me as a terrier dog does a rat. The shock produced a stupor similar to that which seems to be felt by a mouse after the first shake of a cat. It caused a sort of dreaminess, in which there was no sense of pain, nor feeling of terror, though quite conscious of all that was happening. It was like what patients, partly under the influence of chloroform, describe, who see all the operation, but feel not the knife. This singular condition was not the result of any mental process. The shake annihilated fear, and allowed no sense of horror in looking round at the beast." In describing his injuries, he says: "Besides crunching the bone into splinters, he left eleven teeth wounds on the upper part of my arm."

The often related circumstance of the man who went into a sawmill and tried to see how near he could put his finger to the revolving saw without touching it, and on looking, found to his surprise that his finger was gone—and who, a few moments afterwards, illustrated to the proprietor of the mill how he lost his finger by putting one from the other hand so near the saw that he lost that also—although ludicrous, suggests a principle and a line of experiment which might, if investigated and followed out, result in a blessing to humanity.

The principle seems to be this : That rapid vibration, or a series of sudden concussions, even though slight, and not painful of themselves, will produce, in the part subjected to the treatment, a numbness or insensibility in the nerves, which may be immediately followed by a surgical operation without pain or inconvenience to the patient. The means for carrying out this principle are subjects for experiment. A square stick, having rounded corners, rapidly revolved, will produce insensibility in a finger placed so that it may be vibrated by contact with the corners of the stick. It may be a question whether this effect is produced directly by the rapid vibratory motion of the parts, or whether it is due to a compression of the nerves, the effect of which is prolonged by repeated concussions; in any case, it would appear that experiment might bring out a means for producing local anæsthesia or insensibility of the nerves by causing the parts to be vibrated rapidly by some mechanical device.

CANNED MEATS POISONED WITH MERCURY.

In our paper of May 27 we published the statement of Professor Falke, of Manhattan College in this city, to the effect that, on opening a can of cooked corned beef, bearing the stamp of a Chicago company, which he had recently purchased at a respectable grocery here, he noticed some globules of metallic mercury ; and on examination of the meat, found additional quantities of the poison in the form of albuminate of mercury. Professor Falke mentioned the matter before the Academy of Sciences, and the can was examined by the members. After some discussion the conclusion reached was that the presence of the mercury was accidental, caused doubtless by the accidental breaking of a thermometer bulb in testing the heat of the can, etc.

This statement having met the eye of one of our esteemed correspondents at the West, he wrote to us, stating that it was common at some establishments in his vicinity to seal the cans with mercurial solder, and that possibly that had something to do with the case in question. We deemed it hardly possibly that intelligent parties engaged in supplying the public with canned food would venture to make use of so dangerous a material in such a connection; and we therefore wrote to our correspondent, asking him to send us a specimen of the solder in question. He did so, and we caused the solder to be analyzed at the laboratory of Professor A. R. Leeds, Stevens Institute. We were surprised at the result, showing, as it did, that the solder contains a large quantity of mercury, which is at once liberated under the heat of the soldering iron, and is readily condensed in metallic form. This appears to be a sufficient explanation of the presence of free mercury and of albuminate of mercury in Professor Falke's case ; and warrants the conclusion that the many cases of sickness from partaking of canned meats, reported in the papers, may be due to the same cause.

Mercury is mixed with the solder in order, doubtless, to make it run and seal more easily ; but it is a dangerous and subtle poison, and its employment in connection with canned foods should be prohibited under severe penalties. We hope our legislators will promptly move in the matter.

In the meantime, we caution our readers to avoid the use of foods that are put up in *mercury-soldered cans*.

Any chemist or intelligent person, by a few simple tests, can quickly determine the presence of mercury in the solder. In the specimen sent to us, the mercury is revealed by simply heating a bit of the solder in a small test tube over a lamp flame. The metal condenses on the interior of the tube, and a bright globule may be soon collected.

THE CENTENNIAL EXPOSITION.

We noted, not long ago, the excursion of the 4,000 employees of the Singer Sewing Machine Company to the Centennial. The admirable example thus set has been followed by other large employing concerns, and it is to be hoped that parties of working men will be despatched from all our great manufacturing establishments. Employers will find it directly to their interest to encourage these excursions, and to grant the men the necessary holidays. To examine the Centennial, even rapidly and cursorily, is to receive almost insensibly a vast amount of useful information. Besides, as we have already suggested, the advantages thus to be gained will be enhanced if the workmen are required to make some report of what they have seen relating to their own trade, on their return. A suitable reward might be offered for the best report, and thus many might be induced to observe more closely than they otherwise would. Those who stay at home might be constituted the jury for decreeing the reward, and thus, being obliged to hear all the reports, they as well as the excursionists will share in the advantages of the journey.

Of course, the hot weather has kept away large numbers of people from Philadelphia. Still the attendance is reported to be large and to yield remunerative returns. This certainly is encouraging, as no one would have been surprised had the receipts fallen off seriously during the heated term. The rush will probably begin about the first of September; and from that date until the Exposition closes, the buildings will be thronged. Those, however, who saw the grounds just before the present hot weather set in, probably saw them at their best, as the vegetation has been sadly injured by the drought, and the asphalt pavements, becoming melted, have lost their smooth surface.

As a market, the Centennial as proved a great success. Our people have bought out whole foreign departments, and in many sections it is hardly possible to find an object not ticketed "sold." The foreign buyers of American goods have likewise purchased liberally. The New England exhibitors of cotton and wool machinery have found some good customers in the Brazilian staple and fleece displays. The *Boston Commercial Bulletin* reports that probably two large mills, from Yankee plans and Yankee fittings, will be built in Brazil. Over a hundred and fifty thousand dollars worth of pumps, engines, blowers, and drills have thus far been sold to South American buyers. Boot and shoe machinery is also, we learn, meeting a splendid foreign sale ; and even in objects of art—notably furniture—the sale of a fifteen thousand dollar suite to a Parisian house shows that American art industry is by no means unappreciated. Those who have made a study of the business aspects of the Exposition predict an enormous trade in the fall ; but it is stated that exhibitors manifest too great carelessness in selecting the persons who explain their exhibits. There seems to be almost a dearth of smart salesmen, while all such on hand are said to be succeeding beyond all expectations. There is one manufacturer who exhibits his own machine in a way that may serve as an example for general emulation. The device is a very ingenious safety lock for elevators, and under ordinary circumstances would probably be shown in the model. The manufacturer, however, decided to exhibit the invention on a full sized working elevator; and when the judges came to examine the device, he had everything in readiness. Entering the car, which he had previously loaded heavily with pig iron, he was lifted to a hight of about thirty feet ; then he coolly reached upward and began to hack at the supporting rope with his knife. Consternation speedily became manifest among the judges. Some implored him to come down, that they were satisfied, and did not want to see him killed. The imperturbable inventor went on hacking at the rope, which suddenly parted. The spectators turned away so as not to see the rash man dashed to pieces ; but instead of gratifying their anticipations, the elevator car was instantly caught, and actually jumped up a couple of inches above the marked point for its stoppage. From the expressions of the judges, that exhibitor may expect a favorable report ; and as he adopts the same startling plan for attracting visitors' attention, it is needless to say that a crowd always surrounds his exhibit.

So much has been said and written about Japan that her neighbor,

CHINA,

through the general similarity of the exhibits, has come in for little or no attention. And yet the Chinese display embodies some articles as marvelous in their workmanship as the Japanese lacquers and bronzes. At the entrance of the section is erected a large massive door of a temple, curiously ornamented with Chinese characters and oddly contrasting colors. The same general design is followed in the show cases, which have roofs like pagodas, terminating in graceful peaks and spires. In lacquered ware products, Japan excels ; but in the more minute arts of carving and inlaying work, the Chinese are the superiors. Certainly, some of their carvings in ivory and mother-of-pearl reveal a patience and delicacy of touch nothing short of marvelous. Commencing on the west side of the section, the attention is attracted by a large display of ancient vases and ornaments. Some of these are of immense age ; and they are of the highest value, as showing, probably, the earliest efforts of Chinese art. The designs, which are strikingly original, consist of strange looking birds, and animals, and natives engaged in various occupations. There is one pair of enormous vases, ornamented with handles fashioned to represent elephants' heads. On the eastern side of the section are shown handsome screens, elaborately ornamented with pictures of Chinese ladies in beautiful costumes woven in silk. Near, there are cases of curious ornaments cut out of ivory; and adjoining are superb displays of porcelain. Then come specimens of wood carving. By this means, the Chinese give us an idea of their habits and customs, as there are a large number of curious groups, in processions and ceremonials, in which all the figures are carved with the utmost minuteness. There is a multiplicity of carved picture frames, brackets, doors, cabinets, and like objects. Perhaps the most prominent article in the entire display is a bedstead made of fine grained wood, every inch of which is covered with carving of the most wonderful delicacy. The canopy is semicircular, and arches from foot to head. It is made of the finest and thinnest silk—a mere film—and on this are embroidered in silk the most exquisite designs in birds and flowers. It can well be believed that the bed represents the labor of years. Another bedstead, less elaborately ornamented, has been sold for $1,600. There are, beside, numerous exhibits of work and jewel boxes, made of highly polished and costly wood, together with card and chess tables of every form, inlaid with ivory and mother-of-pearl. The specimens of silks are of the finest quality. The colors, especially orange, maroon, and green, are exceedingly lustrous, while the parts that are embroidered exhibit exquisite skill. The rear portion of the Chinese section is filled with china and lacquered ware in endless variety. The department is always full of visitors, and the people seem never to tire of looking at these evidences of the strange civilization of the Orient.

New Caledonia Nickel.

Through the explorations of M. Garnier, New Caledonia now yields a green mineral, consisting of hydrosilicate of nickel and of magnesia, which appears destined to acquire considerable industrial importance. The mineral is found in the midst of very abundant masses of serpentine at various points of the island, and in association with euphotides, diorites, amphibolites, and other magnesian rocks. Sometimes this combination of nickel shows itself on other rocks in the form of a fine green covering ; at others, it penetrates the rocks and colors them intensely ; and again it is found in both filaments and in nodules. As might be expected, the nickel is accompanied by iron, cobalt, and chromium, almost invariably. The metallurgical treatment proposed by MM. Christophle and Bouillet is quite simple. The material dissolved in hydrochloric acid is precipitated by lime under form of a nearly pure nickel oxide. Reduction by charcoal easily gives a metal 99 per cent fine, incomparably purer than that obtained from the sulphuretted and arsenious ores hitherto employed. It is not, however, in the free state that the metal is best used. As combined with copper in the proportion of 15 per cent nickel against 85 of copper, a white malleable and very fine alloy is produced, excellently suited for all metallurgical manipulations.

A rod of brickwork = 272 superficial feet, 1½ bricks thick, or 4,350 bricks average work. One yard of paving = 36 bricks flat or 52 on edge. There are 384 bricks to a cubic yard, and 1,000 bricks, closely stacked, occupy about 55 cubic feet.

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COMPRESSED AIR AS A STREET CAR MOTOR.

M. Louis Mekarski, of Paris, has recently devised a novel mode of using compressed air as a motive power, which he has applied to a street car now in operation in the French capital. The mechanical portion consists in four parts: the reservoirs, the heater, the regulator, and the propelling gear.

The reservoirs, A, Fig. 1, are cylindrical receptacles, made of plate iron, 16 inches in diameter, and are perfectly air-tight. The reservoirs are connected together by copper pipes, and are divided into two series; one constitutes the main or working portion, while the other, of one third the capacity, constitutes the reserve. On leaving the reservoirs, the air passes through a column of hot water, by means of which it becomes saturated with steam at a high temperature, which column is contained in the apparatus shown in Fig. 2. The air enters by a central tube through the rose, C, bubbles up through the water (which is previously injected into the heater at a temperature of 356° Fah.), and finally accumulates in the upper part of the receptacle, forming a mixture with the steam at the pressure of the reservoirs. Instead of allowing the gaseous mixture to enter the cylinders at the reservoir pressure, which is constantly varying, it is caused to pass through a special appliance called the regulator. A conical valve, *c*, Fig. 2, is guided in its travel by the rod, *t*, at whose upper end is mounted the plate, *p*. An air spring, that is to say, a certain quantity of compressed air inclosed in a space, A, and whose pressure is regulated by the movement of the piston, P, exerts upon the plate, *p*, through the medium of the movable india rubber diaphragm, *d*, an action which tends to determine the flow or discharge on lowering the valve, *c*, and to maintain also a corresponding pressure in the chamber, B, which communicates with the motor cylinder by the distributing cock, R. The valve follows automatically the variations of the discharge, closing completely the orifice as soon as the latter stops. The intermissions which result from the employment of the expansion have, therefore, no influence.

For insuring, during the filling of the heater, the closing of the valve, which does not then bear upon its seat with great pressure, while working, the spring, *s*, is employed.

Finally, to prevent the leakages which may be produced through the packing, *g*, traversed by piston, P, the said piston is only made to act directly upon the air spring by means of an interposed cushion of water which it causes to flow in the annular chamber, A. This water, which fills the central space wherein the piston moves when the latter is at the top of its stroke, is admitted by the funnel cock, *e*. The air itself is delivered into the chamber, B, by means of the three-way cock, *v*, which permits, by a very simple movement, the filling of the space, A, with air already having a certain tension. A gage is mounted on this cock. The piston, P, is actuated by the pressure screw, V, which is controlled by a wheel, and which passes through a nut, E, attached to the apparatus by three iron standards.

The hand wheel is worked by the driver. The pressure of air and steam allowed to enter the cylinders is, therefore, regulated automatically to a given point, notwithstanding the variation of pressure in the reservoirs, while, at the same time, this pressure is variable at the will of the driver. On leaving the regulator, the gaseous mixture enters the cylinders, where it acts upon pistons connected with gear more or less like that of a locomotive.

This self-propelling tram car, designed by M. Mékarski, is, as far as the mechanical portion is concerned, quite different from any other motor. On account of the use of air saturated with steam, a high degree of expansion permits of a long run being made with a small quantity of air, the expenditure of which, at a pressure of 25 atmospheres on an ordinary tramway, was less than 11 cubic feet a mile. The working is noiseless.

The principal feature is the ease with which the car may be handled, the operations of reversing, slackening, or increasing speed, and stopping suddenly being performed with far greater ease than with a pair of horses.

At one end of the tramway must be erected some powerful expansive condensing engines, working pumps for compressing the air to a pressure of 25 to 30 atmospheres, and forcing it into the tram cars while they are standing, the excess being stored up in fixed reservoirs. Each tram car, after having completed its double journey, receives its charge of compressed air, while the heat lost during the run by the water in the heater is restored by steam led through a flexible hose. The same system may be applied to engines for drawing ordinary cars after them.

The most important result of this invention is the possibility of storing the air in carriages at a very high pressure (twenty-five atmospheres or higher), permitting a long journey without recharging the reservoirs; nevertheless, in certain cases where it is desirable to reduce the dead weight in diminishing the number or size of the reservoirs, the charging may be effected more frequently by means of supplies of air arranged along the road at suitable distances, and attached to tubes or passages fed by the compressing works.

Fig. 1.

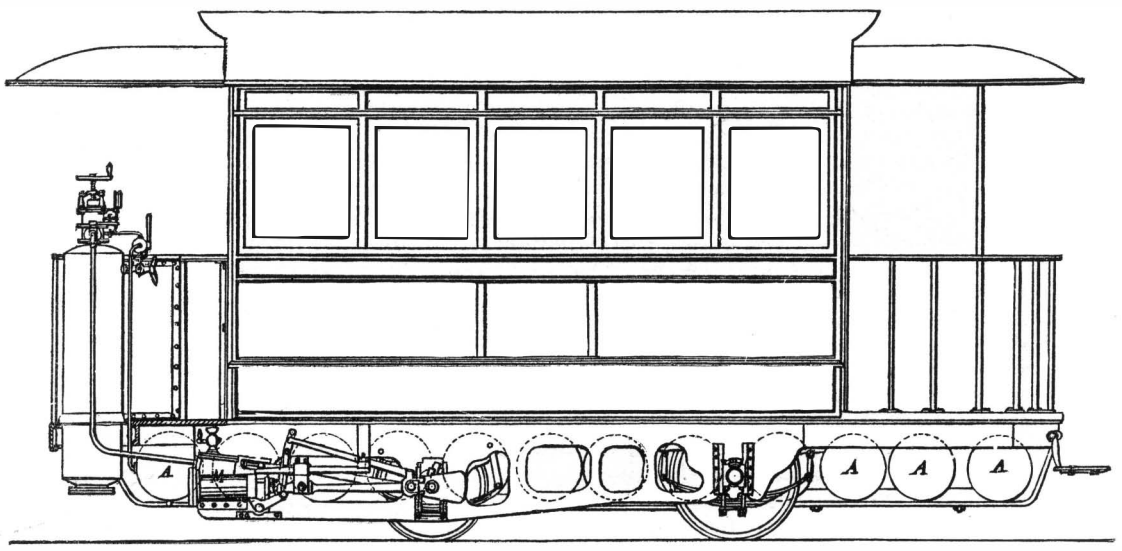
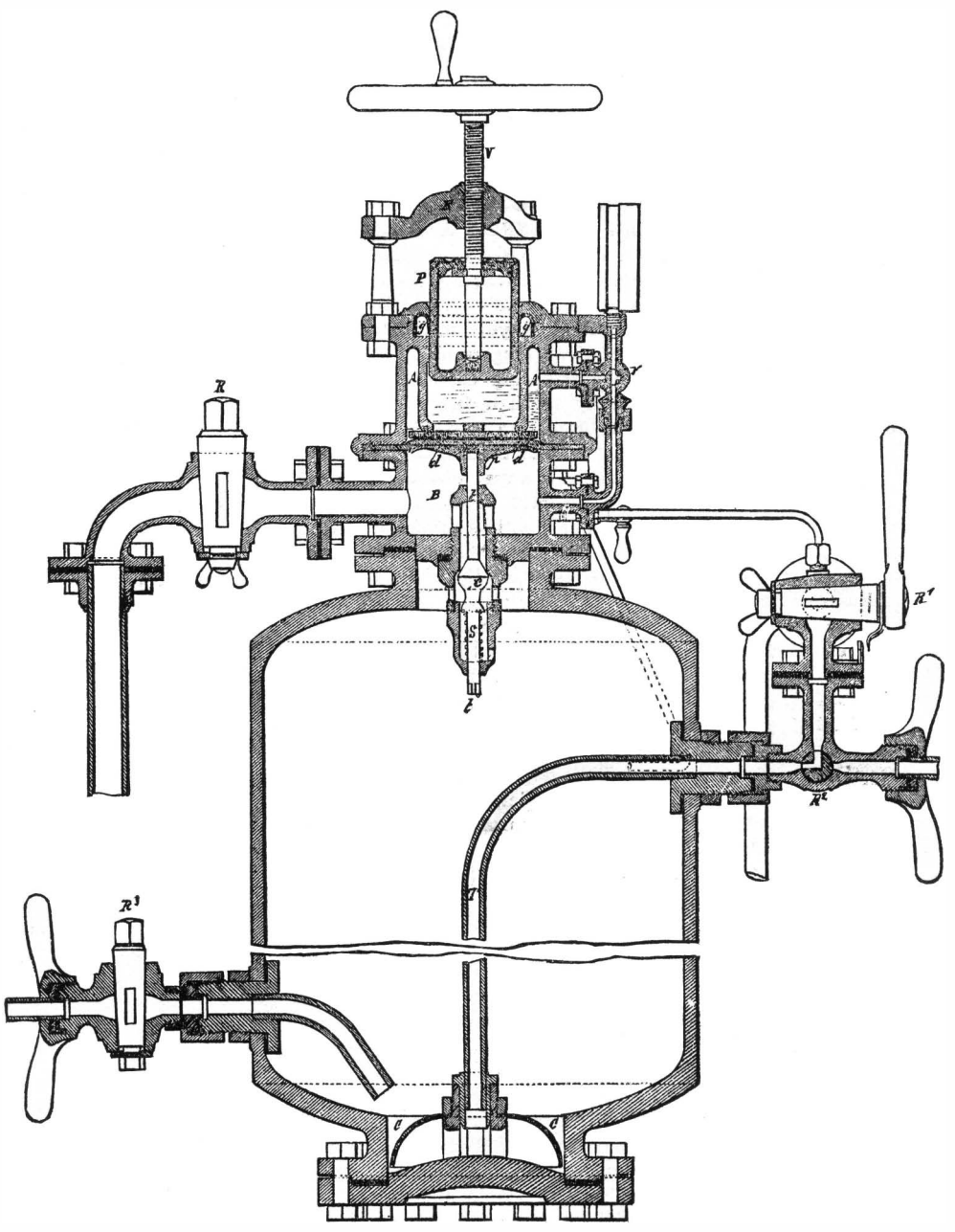


Fig. 2.



MEKARSKI'S DEVICE FOR USING COMPRESSED AIR FOR MOTIVE POWERS.

COCKROACHES may be driven away by putting Scotch or other high-dried snuff round their haunts.

Causes of the Increase of Nervous Disease.

There is a general belief on the part of physicians that nervous diseases are on the increase, and a strong suspicion among many of them that insanity is growing in prevalence.

There is little doubt but that the immense and augmented use of alcohol and tobacco has much more to do with these facts—for facts we hold them to be—than the much-talked-of pressure of modern life, competition, over-brainwork, etc. Insanity from alcohol is observed where this competition is at a minimum, in Guiana, for instance. Dr. J. S. Donald, in a late article on lunacy there (in the *Journal of Mental Science*), observes :—

"With regard to the etiology of insanity in this colony, I cannot say that I find it in any way depending on, or modified by, the nature of the climate. One of the most fertile causes is intemperance. I have noticed this more particularly among Creoles and Portuguese, and in many cases I have been able to trace alcohol as the direct agent.

"Among the lower classes rum is mostly used, and frequently in the form of high wines, rum 40 over proof. It can easily be understood that this in time seriously interferes with the bodily health, and, acting as a poison, eventually produces cerebral lesions."

Not less certain is it that tobacco brings about the same result. Some years ago the French government directed the attention of the Academy of Medicine at Paris to this subject. A scientific statistician with an imperial commission was empowered to collect facts and data for a report, and a commission was appointed to enquire into the influence of tobacco on the human system. The report stated that a large number of the diseases of the nervous system and of the heart, noticed in the cases of those affected with paralysis or insanity, were to be regarded as the sequence of excessive indulgence in the use of tobacco. M. Jolly said that "tobacco seems primarily to act upon the organic nervous system, depressing the faculties and influencing the nutrition of the body, the circulation of the blood, and the number of red corpuscles in the blood." Attention was also called to the bad digestion, benumbed intelligence, and clouded memory of those who used tobacco to excess.

Dr. B. W. Richardson, of London, observes that "smoking produces disturbance of the blood, of the stomach, heart, and brain, of the organs of sense, and of the nervous filaments of the sympathetic and organic nerves." Again, he states that "tobacco smoking arrests oxygenation of the blood, and thus interferes with the full development of the structures of the body, especially in the young."

For all this, it is ominous to note that in Great Britain, from every fresh return compiled, the use of tobacco is fast increasing, even when due allowance is made for increase of population. A recent report of the Inland Revenue Commissioners shows that, in the year 1841, 23,096,281 lbs. weight was cleared in the United Kingdom, giving 13¾ oz. per head of the population; while in the year 1874 the weight cleared was 46,991,590 lbs., being at the rate of 1 lb. 7 ozs. per head.

In the United States, France, and Germany, the same is apparent.

In this connection, it is noteworthy that Dr. A. F. W. Lyle states, in the Cincinnati *Lancet and Observer*, that sassafras counteracts the injurious effects of tobacco on the nervous system. This, he adds, was first pointed out by Dr. Thompson, of Nashville, Tenn. A few drops of oil of sassafras, mixed with smoking tobacco, will, he asserts, render it innocuous.—*Medical and Surgical Reporter.*

LINSEED OIL VARNISH.—Boil linseed oil, 60 parts, with litharge, 2 parts, and white vitriol, 1 part, each finely powdered, until all water is evaporated. Then set by. Or, rub up borate of manganese, 4 parts, with some of the oil, then add linseed oil, 3,000 parts and heat to boiling.

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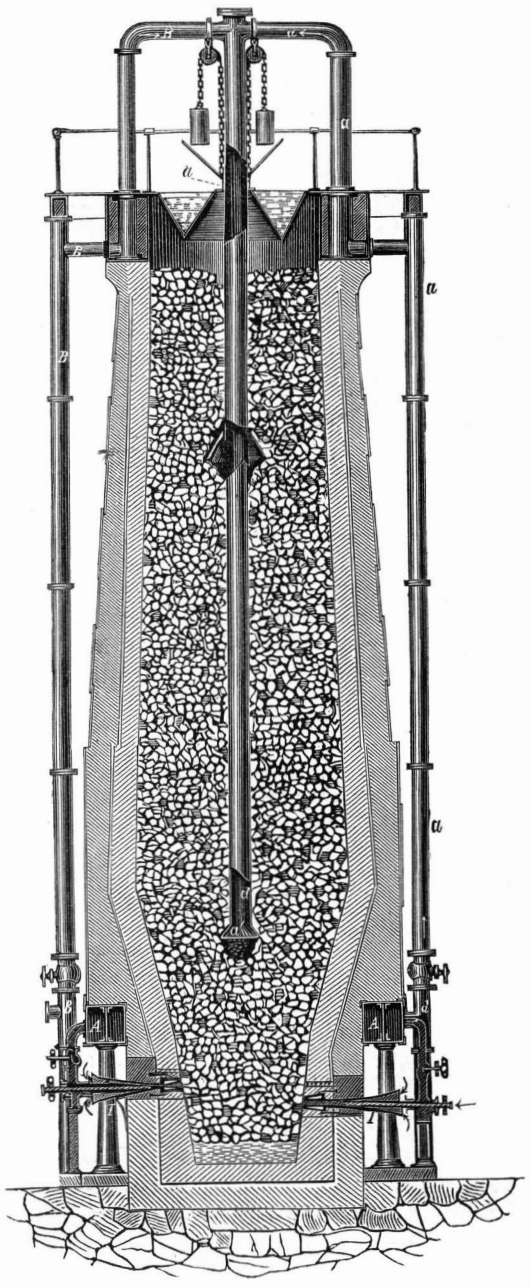
THE UTILIZATION OF PETROLEUM AND NATURAL GAS IN BLAST FURNACES.

The siderurgical value of petroleum depends greatly on its composition, and necessarily varies therewith. According to an analysis made by Professor Wurtz and published in the *Moniteur Industriel Belge* (from which journal we translate and condense the following), the composition of crude petroleum is: Carbon 84, hydrogen 14, oxygen 2—100. Or supposing that the 2 per cent of oxygen is combined with the hydrogen: Carbon 84, hydrogen 13·75, water 2·25—100. If the petroleum be incompletely burned, so that the carbon is transformed into the oxide and hydrogen into water, the siderurgical value of the petroleum may be calculated as follows: 34 lbs. of carbon require 112 lbs. of oxygen to effect the formation of carbonic oxide, and 112 lbs. of oxygen correspond to 4,306 lbs. of atmospheric air, the latter being considered to contain 26 per cent of oxygen. The products of combustion will then be formed of 196 lbs. of oxide of carbon, 126 lbs. of water, and 631·75 lbs. of nitrogen. De-



termining the number of calories (French) disengaged by the transformation of the carbon and hydrogen, subtracting the latent heat of the water, we obtain 592,507 calories as the heat produced by 100 lbs. of petroleum incompletely burned. This corresponds to a temperature of combustion of 3,205·4° Fah. By similar mode of calculation it is found that, when the combustion of petroleum is complete, carbonic acid and water being the results, the temperature is 1,272·6° Fah. greater, or 4,478°.

While the incomplete combustion of petroleum may thus serve for the fabrication of iron, it becomes obviously desirable to insure the complete combustion. The most important question to resolve then is what quantity of petroleum is necessary to produce a tun of iron (2,240 lbs.) This will naturally vary according to the nature of the ore employed. In the northwestern part of Pennsylvania, the cold blast furnaces absorb about 90 bushels of Connersville coke, containing 3,260 lbs. of carbon, to produce a tun of iron with magnetic oxides (or about 1·43 tuns of coke to 1 tun of iron). The ore necessary to produce 1 tun of iron contains 853 lbs. of oxygen, which require 640 lbs. of carbon to effect transformation into carbonic oxide. With these data the author finds that the consumption of petroleum per tun of iron is, for reduction, 256 lbs.; separation of the oxygen from the metal, 239 lbs.; fusion, waste, etc., 157 lbs. Total, 652 lbs., or about 97·5 gallons. He also makes similar calculations with regard to natural gas, such as is derived from the wells in Pennsylvania, Ohio, and elsewhere. The composition of this gas may be considered as carbon 64·01, hydrogen 21·31, water 0·26, nitrogen 4·31, carbonic acid 10·11—100. Considering first complete combustion, developing carbonic acid, the calorific value of gas per 100 lbs. is fixed at 1,136,561 calories, corresponding to the temperature of 4,262° Fah. Incomplete combustion producing carbonic oxide gives a calorific value per 100 lbs. of gas of 773,048, or the temperature of 3,275·6° Fah

It has been proposed to practically utilize petroleum in blast furnaces by vaperizing it by means of superheated steam and then introducing it into the combustion zone with the blast. Thus employed, however, the hydrocarbon is but incompletely consumed, and the temperature practically gained is not sufficient to insure the advantageous working of the furnace.

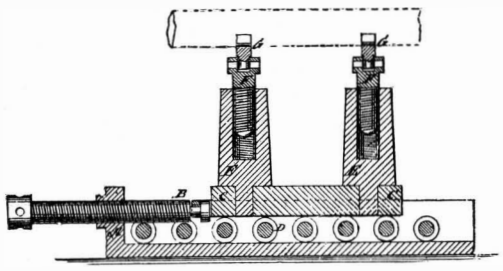
To avoid this difficulty the author, Mr. Charles Plagge, has devised a new apparatus whereby the influx of petroleum is divided, so that there is led into the combustion zone only that portion necessary to meet the reduced iron and the scoriæ; while the remainder of the petroleum, which roasts, reduces, and carbonizes the metal, is conducted into the upper or reducing zone of the furnace. The annexed engraving is a section of this device. The petroleum and the blast necessary for roasting are led by a central tube, which plunges into the reduction zone to a depth determined by experiment. In order to protect this tube from the heat, it is enveloped in a larger tube. There is thus formed an annular chamber for the circulation of hot and cold air, which enters from above and leaves the outer tube by special apertures, to pass into the furnace a little below the upper surface of the charge, a hight at which the petroleum enters the reducing zone. This air serves, in addition to preserving the tube, to burn all the gases and vapors, arising from the oil, which have not been utilized by the reduction and the fusion of the iron. The free oxygen, which enters the furnace above the zone of reduction, oxidizes the injurious impurities contained (sulphur, phosphorus, etc.); and the heat produced contributes in expelling the carbonic acid and combined water of the ore, and to heat the latter before its entrance into the reducing zone.

The author claims that by this means more iron can be produced daily, owing to the large quantity of ore with which furnaces can be charged through the absence of solid fuel, and also that the metal produced is of greater purity, owing to the elimination of impurities, as above noted, before it enters the reduction zone. The metal reduced at low temperature cannot be injured by deleterious matters in its passage from the zone of reduction to that of fusion, since it encounters only neutral gases, but very slightly oxidizing or reducing in nature, and since it is submitted to the purifying action of carbonic acid, which transforms into sulphurous, silicic, and phosphorous acids the small particles of sulphur, silicon, and phosphorus which the reduced metal may have absorbed.

A NEW COMPOUND ENGINE JACK.

When locomotive engines run off the track, it is a matter of much labor and difficulty to replace them. Raising the heavy weight vertically presents no especial obstacle, but to move it sideways requires much more labor and mechanical skill. Messrs. William C. Taylor and Rudolph Vampill, of Mullins, S. C., have patented, June 6, 1876, through the Scientific American Patent Agency, an ingenious improvement in compound engine jacks, by means of which an engine may be raised vertically, and then moved laterally to place it upon the rails.

In the annexed engraving, A is a cast iron box, open at the top and at one end, and in the closed end of which is formed a screw hole to receive a screw, B. The screw, B, is operated by means of a wrench or other lever applied to its



outer end. The forward end of the screw is swiveled to the end of the iron block, so that the said block, C, may be moved back and forth by turning the screw. The block, C, or its lower part, fits into the box, B, and rests upon the rollers, D, placed within said box, so that it may be moved easily, even when supporting a great weight. Into the upper side of the block, C, near its ends, are attached two posts, E, the upper parts of which are perforated longitudinally with screw holes, into which enter screws, F, which are turned by a wrench. To the upper ends of these are swivelled cross heads, G, having half-round notches formed in their upper sides. Several posts, E, of different lengths are provided to avoid the necessity of blocking up the jack.

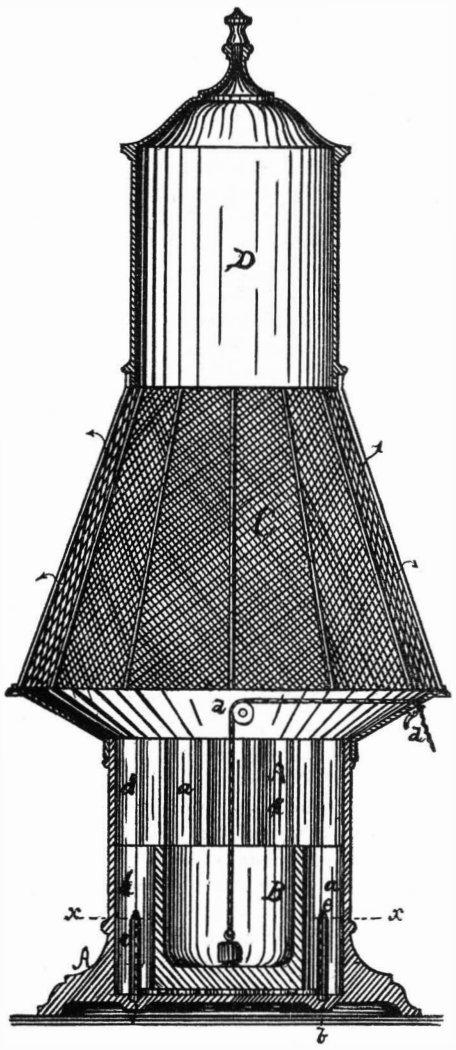
In using the device, it is placed beneath and parallel with the drive axle of the engine; and the screws, F, are turned up until the heads, G, come in contact with the drive axle and raise it enough to let the wheels pass over the rails. The screw, B, is then turned, moving the engine laterally, until the wheels are over the rails. The screws, F, are then turned down, lowering the said wheels upon the rails.

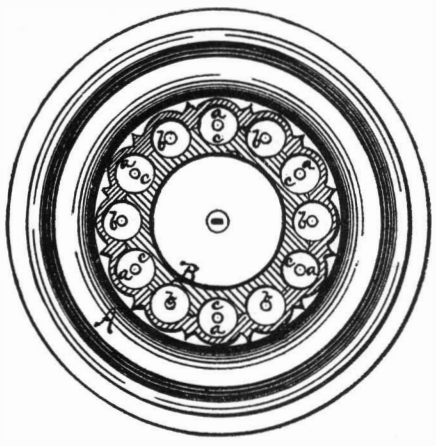
The Washington Monument.

There is a probability that the unsightly pile of stone called the Washington monument, in the national capital, will soon be pushed forward to completion. It is now 174 feet high. The amount required to carry it up to 485 feet and surround it with a terrace 25 feet high and 200 feet in diameter, is estimated at $500,000. This sum there is an effort on foot to raise by public subscription, mainly through churches; but the patriotism of the people so far seems not to have resulted in very liberal donations. The Senate, however, has recently passed a bill declaring that Congress should assume the finishing of the work; and it will, therefore, if an appropriation be made, be paid for out of the national treasury instead of from the pockets of private citizens.

BARTLETT'S OZONE MACHINE.

The novel feature of this invention consists in the construction of the parts by which ozone is generated in separate tubes, and then purified as it passes from the machine into the atmosphere through the chemically prepared stuffs and wire walls. A is a hollow glass vessel having its inner sides formed into a series of half tubes, *a a*, and with sockets, *b*, in the center of each in the bottom. B is an inner cylinder, also of glass, having corresponding semicircular cavities, *c c*, formed on the outside, which, when the plunger is in position (inside the outer vessel, A), will form, in conjunction with the other parts, *a a*, a series of tubes around the interior of the vessel. This vessel, A, comprises the generating chamber. The plunger, B, is made hollow





with a closed bottom, and will be raised or lowered by a cord. The bottoms of the tubes, *a a*, receive phosphorus sticks, which stand up about two thirds of the length of each tube. The sticks are made flat and thin, being from one eighth to one quarter of an inch in thickness, and one inch in width, according to the size of the machine, and the upper part or combustion point is flattened or sharpened, thus giving the best oxidizing point. The object of raising and lowering the inner cylinder, B, is to regulate the hight of water around the phosphorus sticks, and thus graduate the combustion. By this simple arrangement any length of stick desired may be exposed for quick or slow combustion; and the machine may be left for days to run itself, the only attention required being to graduate the water by raising or lowering the plunger. Above the generating chamber is arranged an ozone chamber, C, the walls being formed of two thicknesses of wire cloth, the inner one being of much finer wire than the outer one. Between the two, and surrounding the entire chamber, C, is a porous fabric, which is first treated with an alkali, so that the fumes rising from the oxidizing phosphorus will be caught therein, and the acids and other impurities retained or neutralized by the chemicals having an affinity therefor. An expansion chamber, D, is set above the ozone chamber, C, to receive the surplus products of oxidation and allow them time to become separated from the ozone.

The apparatus is the invention of Mr. F. W. Bartlett, of Buffalo, N. Y., and was patented February 15, 1876.

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Correspondence.

A Few more Words About Locusts.

To the Editor of the Scientific American:

In late numbers of your journal I notice several short articles on the Rocky Mountain locust, especially a note from J. F. Dunwoody, of Louisiana, Mo., taking exceptions to some of the statements and opinions of Professor Riley on the subject, and a brief reply from Professor Riley to Mr. Dunwoody. Frequently two men will take different sides of a question; and, to sustain their opinions, each will quote facts which appear to conflict, and yet the statements of both may be correct. I am convinced, from my own experience, that such is the case here. I have known one instance, very similar to the one mentioned by Mr. Dunwoody, where the locusts were hatched after the eggs had been covered for weeks with water. In the spring of 1868, vast quantities of locusts were hatched in the counties along the Missouri river, between Nebraska City and St. Joseph, Mo. In the following June or July, I saw myriads of locusts that had not been hatched a week, on an island in the Missouri river, just above Brownville, Neb., where the ground had been submerged by the river during the greater part of the spring. This was several weeks after the grasshoppers on the main land on both sides of the river had arrived at full growth and had flown away.

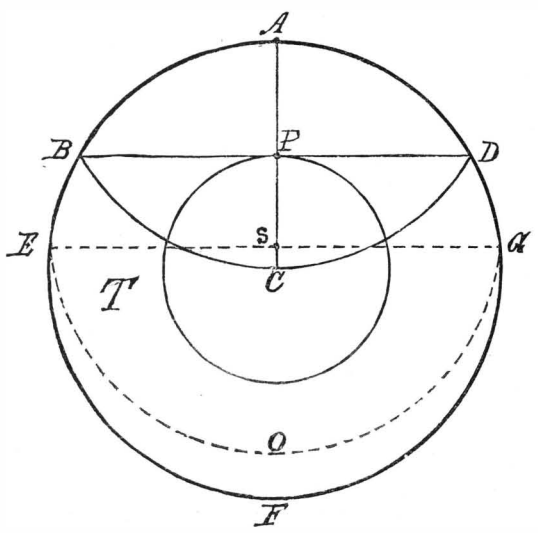
It is a prevalent opinion, among farmers who have tried the experiment, that plowing the ground where the eggs are deposited does not destroy them. But in some instances it does. I noticed, in the spring of 1868, one field that was plowed early, and that contained tuns of grasshopper eggs, many of which were exposed to the surface. They did not get hatched, but gradually changed color and putrified, till the field smelt like a dried-up pond. Why they perished, whether from repeated freezing and thawing or from the heavy rains that washed the cement from the eggs in their new and exposed position, or from the bright sun shining on them, I cannot say. But I did not see any young grasshoppers during the entire season on that field.

Lawrence, Kan. J. R. FISHER.

Weight on and in the Earth.

To the Editor of the Scientific American:

I supposed the "body in a hollow sphere doctrine" had been repudiated, but I find it endorsed by Professor Young in a recent lecture. There can be no doubt as to the falsity of this theorem. Olmstead embodied it in a proposition in his philosophy; and singularly enough, further on he said: "A body lowered toward the center of the earth would lose in weight in proportion to its distance downward." The



hostility between these propositions is unmistakable. A body upon the surface of the earth weighs, say, 24 lbs.; if lowered half way to the center, it passes, according to this queer theorem, seven eighths of the mass, and weighs then but 3 lbs.; but, according to the second proposition, it weighs 12 lbs., having lost 12 lbs. If this latter proposition be true, and there can be much evidence produced in its support, the former at once falls to the ground. In truth, a body would as eagerly fall to the center from any point within a hollow sphere as if the sphere were solid.

A body on the surface, at A, would be attracted by the whole mass toward C; but if lowered to P, the mass above the plane, B D, would attract it toward A, and neutralize the downward attraction of a corresponding inverted volume of matter, B D C. Then it is the lenticular mass, A B C D, that has been rendered neutral in its effect upon the body, at P, instead of the shell, T, as erroneously set forth by this absurd theorem; and the weight of a body, or vibrations of a pendulum, at P, would be due to the amount of matter in, and distance of, the cup shape fragment of earth from which the neutralized mass may be supposed to have been taken. Were the body lowered to *s*, it would be attracted toward C only by the thin and distant shell, E F G O, the rest of the mass being neutral: which shell would disappear as the body reached C. There is much to disprove this theorem, it being little less than a philosophical monstrosity. Theoretically, every solid body would balance in any position if suspended from its center point of gravity. Guided by the theorem in question, we should expect a hollow sphere to so balance, if suspended from any possible point within the void. E. B. WHITMORE.

Rochester, N. Y

Production of Silkworms' Eggs in Italy.

Great attention is being paid in Italy, as stated by Consul Colnaghi in his report upon the yield of cocoons in 1874, to the restoration of the native breeds of silkworms, and apparently with every hope of success. Government stations for microscopic examination are established in various provinces, and private individuals are not behindhand in experimental studies, which, in some cases, have assumed an important industrial aspect. At Albiate, in the province of Milan, there exists the important Cascina Pasteur for the production of silkworms' eggs, founded about 1868-69, and conducted by M. Guido Susani. The Cascina Pasteur has been continually increasing its production of grain under cellular selection, and in 1874 furnished 18,000 ounces (of 25 grammes each) of eggs, a quantity that could be greatly increased on the receipt of early commissions.

Microscopic examination of the moths, and not of the eggs, is the foundation of the system of selection. While, however, this examination is a certain safeguard against the corpuscular disease, or, as it is usually termed in Italy, *la petrina*, it is of no avail against other sicknesses. Here the remedy is found in a series of physiological selections, costing both time and money, and requiring more than two years to be certain of effect. M. Susani has obtained equally good results with regenerated Italian breeds as with the green and white Japanese, which he has reproduced for the last seven years without requiring to renew the stock from Japan. In Lombardy these Japanese reproductions are preferred, and are the only ones generally used. They have given of late better results than the Japanese cards, which are found every year to be more and more infected with disease. In Central Italy the yellow Italian breeds are more usually cultivated. These, when ill attended and if the season is unfavorable, suffer from *flaccidezza*, and this is why the Lombard peasants prefer the cellular selections of the more hardy green Japanese race. Among the Italian breeds M. Susani prefers the old *brianzola* and the *biona*, which he has regenerated, for hill cultivation, or at least for dry localities, and where sufficient care is taken; for the lowlands he prefers a commoner quality.

On a smaller scale than M. Susani's, but very complete in its arrangements, is an establishment in the immediate neighborhood of the small town of Arezzo (Tuscany) overlooking the Val Tiberina, and founded by Count Polidori and Co., three years ago, also for the special purpose of producing silkworms' eggs for sale. M. Colnaghi mentions that he recently had an opportunity of visiting this establishment. A convenient two-storied building has been erected in a garden in which a plantation of young mulberry trees is growing. The rooms in which the silkworms are reared are light, airy, and well ventilated; the open fireplaces are of brick; and by a simple system of tubes communicating with the outer air, a constant supply of fresh air, warmed in its passage through the stoves, is brought into the rooms, the foul air being carried away by means of ventilators. Light wooden frames are raised in each room, leaving sufficient space for the attendants to walk round them. On the frames trays are laid in rows, each tray measuring 30 inches; the hight between the rows of trays is 18 inches. To rear 1 oz. of eggs 72 trays are required—a superficial area of 600 square feet—and they may be placed in a small space if it is well aired. The bottoms of the trays are of string, over which a piece of white gauze is laid to support the worms. Twenty-six microscopes are in use to examine the moths. A power of 560 diameters is considered the most suitable. Sixty women are in constant employment, varying according to the season, in examining the moths and rearing the worms.

The system of microscopic selection used in Italy is that of Pasteur, modified slightly by the experiments of Cornalia and Cantoni. The moths (male and female), themselves carefully selected, are placed in a small gauze bag, where they couple—the female depositing her eggs—and die. After death they are taken out of the bag, the wings carefully stripped off, the bodies pounded, with a little water, in a small porcelain or glass mortar. If on examination under a microscope no sign of corpuscules are found, the eggs are considered healthy. The examination of the eggs themselves is not required, being superfluous if the moths are healthy, and useless when they are not, as the germs of the disease may be contained undeveloped in an apparently sound egg. The healthy eggs are suspended in the little bags in a cool and airy place. For the due hatching of the worms in the following spring, it appears to be absolutely necessary for the eggs during the winter to be exposed to the influence of frost, or at the least to a certain degree of cold.

Count Polidori and Co. rear worms enough to produce 3,000 ozs. (of 28 grammes each) of grain, for which about 270,000 couple of moths have to be examined under the microscope. The breed of the worms at present obtaining the preference at the Anghiari establishment is the French Roussillon, which produces a small but compact and well made cocoon, contracted in the middle, yellow in color, with a slight roseate hue. The silk is elastic and lucid. The cocoon resembles that of the well known brianza breed, of which it is probably a descendant. The yellow Tuscan breed, although it has been preserved in the province throughout the the silkworm disease, is said to be weakly; the cocoons do not spin well. The Novi breed (white cocoon) yields a beautiful silk. A race of worms from Sardinia, with a roseate cocoon, was of good promise, as also a French breed from the Var, of striped worms, and producing a nankin-colored cocoon.

With reference to the product of the various breeds, on an average 1 oz. Japanese grain yields from 35 to 45 lbs. of green cocoons; 1 oz. of Japanese grain, reproduced in Italy, yields from 85 to 95 lbs. green cocoons; 1 oz. of Italian green yields about 130 lbs. yellow cocoons; 1 oz. French striped breed (Var) yields about 78 lbs. nankin cocoons; and 1 oz. of Roussillon yielded last year 175 to 190 lbs. yellow (roseate tinted) cocoons; but this was a maximum, and cannot be taken as the average.

Electric Conductivity of Carbon.

"The following simple method of exhibiting the conducting power of carbon was brought to my notice by my friend Mr. W. J. Ward, of the metallurgical laboratory of the Royal School of Mines, as having been shown to him several years since by Dr. von Kobell, of Munich. As I have not found any account of it published, I have ventured to bring it before this society.

"A fragment of the substance to be tested, whether charcoal, coke, anthracite, or other form of carbon, is held between the jaws of a pair of tongs formed by bending a strip of zinc into a horseshoe form, and immersed in a solution of cupric sulphate. If the carbon is a non-conductor, the copper salt is decomposed, and deposit of copper only takes place on the immersed surface of the zinc; but when it possesses a high degree of conductivity, a zinc carbon couple is formed, and deposit of copper takes place on the surface of the carbon as in ordinary electrotyping.

"Of the different forms of carbon experimented upon, the most rapid results have been obtained with some American anthracites, and coals that have been subjected to the action of intruded igneous rocks. The most remarkable of these is an anthracite from Peru, which contains a large amount of sulphur in organic combination, and is found in a nearly vertical position, interstratified in quartzite, in the high plateau of the Andes, about 13,000 feet above the sea level, near Truxillo. It is probably of secondary age, the metamorphism having taken place at the time of the great trachylic outbursts which form the gold and silver bearing rocks of the adjacent mining district. This is coppered by immersion almost as readily as graphite. The anthracite of Pennsylvania possesses the same property, but not in quite such high degree. The heathen coal of South Staffordshire, when altered by the intrusion of the white rock trap, is more slowly coppered; but this is probably due to the resistance interposed by the numerous laminæ of calcite filling the fractures in the mass of the coal, which renders the conductivity less perfect. A specimen of coal from Bengal, altered in the same manner by intrusion of igneous rocks, behaves much in the same way as coke, being coppered directly. This is rather remarkable, as this coal is a very impure one, and contains such a large quantity of water, very intimately combined, probably as a hydrated silicate interspersed through the mass, as to decrepitate explosively when suddenly heated.

"The ordinary Welsh anthracite does not appear to be a conductor by this method; but after having been heated to a full red heat, it conducts electricity freely. The lowest temperature at which this change takes place appears to be somewhere between the melting points of zinc (806° Fah.) and silver (1832° Fah.), as fragments of anthracite packed in a thin clay crucible and plunged into molten zinc were not found to be altered, but were changed when heated in a bath of melted silver. These limits, although considerably wide apart, are interesting as giving a possible clue to the temperature at which anthracite metamorphism of coals has been effected in different districts. Mr. W. C. Roberts has recently shown that the alloys of silver and copper have very definite melting points; it will be possible, therefore, to determine more nearly the lowest temperature necessary to produce the change.

"In the South Wales anthracite district, it is well known that no great amount of disturbance has taken place in the position of the coal seams, while in North America and Peru the change has been accompanied with much more violent action, as evidenced by the greater disturbance of the rocks; and probably a correspondingly higher degree of heat was developed in the mass. The evidence afforded by the coals that have been actually altered by intruded rocks, and must have been highly heated, appears to bear out this view. On the other hand, long continued exposure to a lower temperature might possibly produce the same effect, and further experiments upon this point would be desirable."—*H. Bauerman, F. G. S.*

Paper Car Wheels.

The American Paper Car Wheel Company, of Hudson, N. Y., has specimens of 30, 33, and 42 inches wheels of its manufacture. These wheels have steel tires made with an inside flange and a cast iron hub. On each side of the hub and tire, wrought iron or steel plates 3-16 inch thick are bolted, and the space between the plates is filled with compressed, or rather condensed, paper. This paper is made of straw boards $\frac{1}{8}$ inch thick, pasted together with paste made of rye flour., and first made into sections about $\frac{1}{2}$ inch thick. These are subject to a pressure of about 400 tuns for about five hours, and are then dried with hot air. These sections are then pasted together in the same way, so as to get the requisite thickness, about $3\frac{1}{2}$ inches, and are again pressed and dried. They thus form a disk, which is turned off and the tire forced on with a pressure of about 150 tuns. The plates are then bolted to the inside and outside of the wheel with $\frac{3}{4}$ inch bolts. An old wheel is exhibited, "one of the first paper car wheels ever made. It has run under a Pullman car 312,900 miles without the tire being turned." One of the wheels is shown with a portion of the plates and paper disk cut away, so as to show the inside structure. One of the paper disks is also exhibited; and if a separate

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tire and hub were shown, the exhibit would be complete. The wheels are painted brilliantly red, which might be described as mono-chrome-engineering.

Guanine.

The perfectly white solution of the scales of the bleak (*leuciscus alburnus*), a fish indigenous to the rivers of France, is now used largely for the manufacture of artificial pearls. The solution or guanine is a mucus which lubricates the scales of the fish. It coagulates by heat to a thick, white deposit, and is obtained by carefully scraping the fish over a shallow tub containing fresh water. Care is taken not to scale the back or dorsal part, as these scales are yellow, while the white scales possess the value. The material is received on a horsehair sieve. The first water, mixed with a little blood, is thrown away. The scales are then washed and pressed, when the mucus or essence (guanine) sinks to the bottom of the tub and appears as a very brilliant blue-white oily mass. It takes 40,000 fish to furnish two pounds of the material. The fishermen seal it in tin boxes with ammonia, and in this condition send it to Paris. If a drop of the essence be taken up by a straw and let fall upon water, it floats, giving forth the most brilliant colors. Mere glass bulbs, in shape of pearls, lined with this substance, imitate the real gems with remarkable closeness.

PRACTICAL MECHANISM.

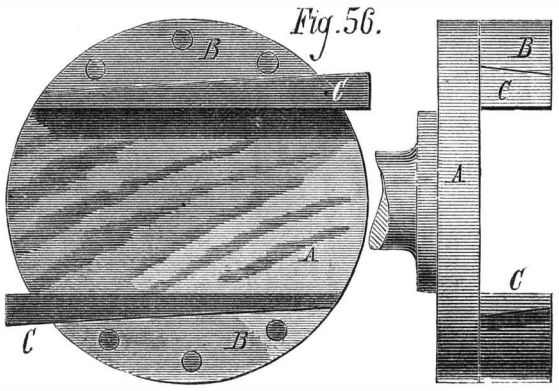
BY JOSHUA ROSE.

SECOND SERIES—Number VIII.

PATTERN MAKING.

Fig. 56 represents a side and face view of a very useful chuck, suitable for holding core boxes while boring them. It is shown attached to one of the metal plates that fit the mandrel of the lathe, and is usually made of hard wood; but for a large sized one, say 15 or more inches in diameter,

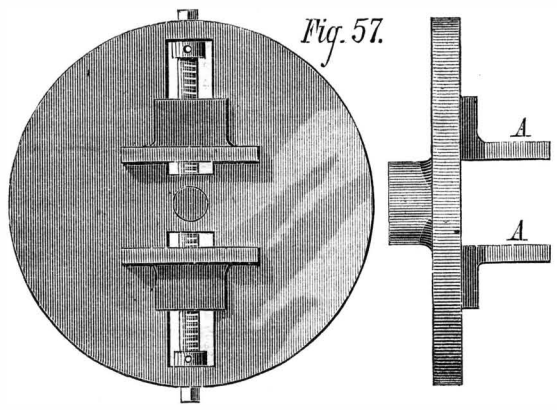
Fig. 56.



the disk portion, A, may be made of pine wood. The two sides, B B, are firmly fixed to the disk, their inner edges being planed at an acute angle to it. The work is held by driving the wedges, C C, and may be truly chucked by them in a comparatively short space of time.

Another very useful chuck is shown in Fig. 57, and it will

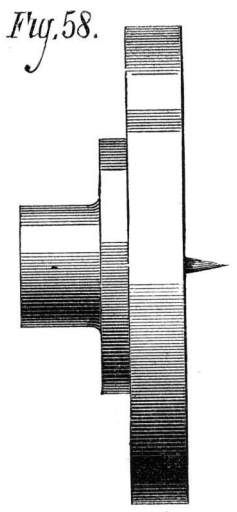
Fig. 57.



answer the same purposes as that shown in Fig. 56. It is, however, made entirely of metal somewhat similar to a machinist's dog chuck, but much lighter. Pieces of wood may be screwed on the jaws at A A, and bored to the curvature of any round piece of wood, an advantage which the chuck shown in Fig. 56 does not possess. Or the jaws may be turned round in their places, so that the faces, A A, will stand outwards, and the wooden pieces screwed thereon may be made to fit a hole. This chuck will be found to save much time over the plan of screwing work to the common face plate. V pieces of wood may be fixed to the jaws, and a piece of work in the rough held by them during the process of facing, boring, and turning the projecting part. The work can then be reversed in the chuck, and similar operations performed on the opposite end; and the work can be taken from the lathe and tried as to either fit or conformation, and, if necessary, restored in a moment to its original position in the chuck, so as to run quite true; but at the same time, for first class work, it is better not to use the Vs on finished surfaces. For holding bits and small work, neat little chucks may be purchased at the hardware stores, and they act similarly to the nipping arrangements applied to boring braces. These chucks can be supplied to either screw on the lathe mandrel; and they will, with a taper shank, fit into the taper hole provided to fit the holes which receive the lathe centers. It is well to have one of each, so as to be able to use one of them in place of the still lathe center, to operate upon work already chucked on the face plate of the lathe.

A simple and very useful chuck still remains to be described, being what is known as the cement chuck, which is made as follows: A disk of hard wood is screwed to a metal plate, where it should remain permanently; but if the face plate cannot be spared, bore a slightly taper hole through the disk, a little smaller than the diameter of the screw of the lathe mandrel, and partly through the disk. Then screw the disk on the mandrel, working the disk backwards and forwards to form a thread in the bore of the disk, and then turn and face it perfectly true. Then bore a small hole in its center, and drive in a piece of soft steel wire, leaving a short length projecting from the face and turn it to a point, as shown in Fig. 58.

Fig. 58.

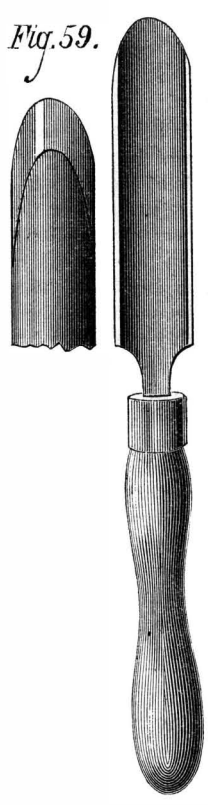


The object of this chuck is to drive thin delicate work, which it would be difficult to screw or clamp by adhesion, and this is accomplished as follows: We first prepare a wax composed of 8 parts of resin to 1 of the best beeswax, melted together, and we stir them well together, and run the mixture into tubes of paper or other suitable molds. To chuck the work, we take a stick of the wax, and press its end against the face of the chuck while the lathe is running, and then place the center of the piece of work on the steel point, applying sufficient pressure to cause the steel point to force its way into the work. Just before the work touches the waxed surface, we throw the lathe belt on to the loose pulley; and the momentum of the lathe, combined with a moderately heavy pressure, will generate, by friction, sufficient heat to melt the wax and cause the work to adhere to the chuck. The work may be detached, when necessary, by inserting behind it a thin wedge or blade.

TURNING TOOLS.

The turning work necessary in making patterns is usually done by hand; although on small and plain work, such as simple boring and facing, slide rest tools may be used to advantage, inasmuch as they will operate quicker than hand tools. Since, however, pattern lathes are not usually provided with slide rests, we shall confine our remarks to hand tools. For roughing out, the turning gouge, shown in Fig. 59, is used. In grinding this gouge, it is necessary to lower the back hand when grinding at and towards the outside corners, so that the cutting edges may be formed, by the junction of two faces, at as acute an angle as those forming the cutting edge in the center of the width of the tool.

Fig. 59.



It is always the custom to reduce the work in the lathe to nearly the required form by this tool, the finishing tools being (with one exception) simply scraping tools, and not, properly speaking, cutting tools; hence it is evidently inadvisable to leave much for them to take off. The manner of holding the gouge is shown in Fig. 60. One hand grasps the handle near the end, while the other grasps the gouge near the cutting point, that is to say, as near as the hand rest will permit. It is sometimes, however, necessary to slightly vary the manner of holding by passing the forefinger of one hand around the hand rest while the gouge is confined between the thumb and forefinger, thus gripping the gouge end to the rest. This is advisable when turning a piece of work that is not completely round, as, for instance, tipping off the teeth of a gear wheel, in which case gripping the gouge to the hand rest will steady it and prevent it from digging into the work. The gouge is shown, in Fig. 60, to be cutting from left to right; it will, however, cut equally well if used from right to left, in which case the position of the hands must be reversed, the left hand gripping the gouge near the cutting edge. In either case, however, the gouge is not held horizontally level, but is tilted to one side, the lower side being the cutting one, otherwise the tool would rip into the work.

Fig. 60.

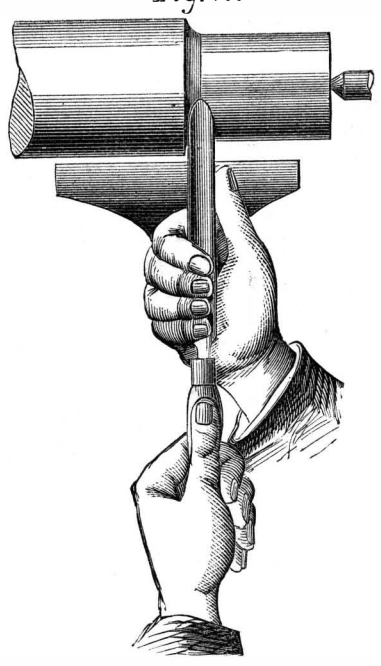
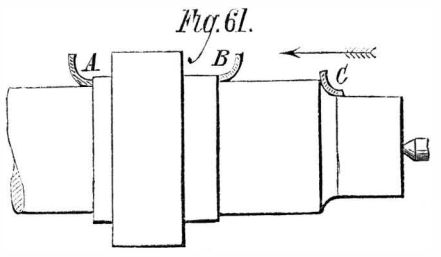


Fig. 61 shows the section of the tool and the tilt of the tool when cutting from right to left; while that of the tool, A, shows tilt when cutting from left to right. The reasons for this are as follows: The face of the gouge, on its hollow side and near the cutting edge, receives the strain which is necessary to curl the shaving, that is to say, which is necessary to force it out of the straight line. But if we were to place the gouge in the position shown in Fig. 61, at C, the whole of this strain would be placed upon the gouge, tending to force it forward and into the cut, as denoted by the direction of the arrow; and as a consequence, the gouge would run forward and dig into the work, in spite of all endeavors to prevent it. When, however, the gouge is held in the positions relative to its line of travel to its cut, shown in Fig. 61, at A and B, there is but little tendency for it to run forward, and it can be fed easily to its cut. In addition to its use as a roughing tool, the gouge makes a very efficient finishing tool for hollows, though it is not often employed as such by patternmakers. In this case, however, great care must be taken in controlling its position to the work, as shown in Fig. 61.

Fig. 61.



Trial of a Weeding Machine.

A trial of a weed eradicator, manufactured by Messrs. Ord and Madison, Darlington, Eng., lately took place under the auspices of the Highland Agricultural Society. The object of the machine is to remove the weeds which grow among corn crops. A drum, about 24 inches in diameter, is placed between two carrying wheels. Three sets of projecting teeth or iron combs run horizontally along the drum. This, when the machine is in operation, revolves by the action of the gearing, the combs at the same time working in and out of the slits, and over and along the top of the crop. Supposing the ground to be soft, the teeth catch the weeds and pull them fairly out of the soil; but should the soil be hard, as was the case at the trial, and thus have a firm grip of the roots of the weeds, the combs tear off the heads, so that they are prevented from seeding, leaving the stem in the soil. As the drum revolves and the teeth are drawn in towards the center, the weeds or their heads come in contact with the circumference of the drum, and, not being pulled in at the slits, are allowed to drop to the ground. The teeth exert little or no action upon the crops, passing between the teeth.

Remedy for Obesity.

According to Dr. Philbert, the waters of Brides in Savoy, which are very similar to those of Carlsbad, are very useful in the treatment of obesity. The purgative salts contained in these waters are sulphate of soda, chloride of sodium, chloride of magnesium, sulphate of magnesia, and sulphate of lime. To increase the effect, from 15 to 80 grains of sulphate of soda are added to each glass of mineral water. The quantity taken daily is $\frac{4}{5}$ quart, divided into three doses, and the purgative effect is produced in two or three days. The course may last from four to six weeks. As an adjuvant to the waters, a vapor bath may be taken every day or every second day. Farinaceous and saccharine articles of food are not allowed, and brandy, liqueurs, and coffee are interdicted; but the quantity of food is not limited, and a moderate amount of wine may be taken without harm. Muscular exercise is considered indispensable, and the mountains in the vicinity of Brides afford every facility for walking, where, in addition, this treatment may be followed by the grape cure.

A College of Cookery.

At last a practical step has been taken towards emancipating the people from the evils of bad cookery. We know of no department in domestic economy which is so sadly in need of reform, especially in the United States. Mr. William Emerson Baker, of the sewing machine firm of Grover & Baker, has given to the Governor of Massachusetts and to four other trustees a farm of 50 acres and $50,000, to form a college of cookery. Cookery is to be taught as an art—which it certainly is—and the pupils are to be instructed in the scientific principles which underlie wholesome cookery. The horrible pies, fried meats, hot bread, and other dyspepsia-generating compounds, together with the inexplicable concoctions produced by the verdant Milesian handmaid, let us hope, are doomed to disappear; and instead, our kitchens are to be tenanted in future by culinary artists able to prepare, palatably and healthfully, the vast variety of food this country affords.

Farming in California.

Some idea to what vast extent farming is carried on in California, and some other Western States, may be formed from the following item in one of our exchanges: "Plowing in unbroken furrows six miles long can be seen in Fargo, California. The teams start in the morning and make one trip across an entire township and back before dinner, and the same in the afternoon, making 24 miles' travel every day." It would seem that the steam plow ought to find a place in such a region.

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IMPROVED ADDING PENCIL.

In our issue of October 21, 1875, we published an illustration and description of a then recently patented adding pencil, the device of Messrs. Smith & Potts, of Verdi, Nevada. Our readers may remember that not long afterwards we printed a paragraph containing a request from the above named inventors that the public would withhold further letters, as so great was the interest excited by the very ingenious little device that the proprietors found themselves entirely unable to attend to the innumerable requests for further information and orders which poured in upon them. Nearly 5,000 pencils, we are told, have been sold, and the sale may be traced to that publication—a significant evidence not only of the value of the device but of the advantages of the SCIENTIFIC AMERICAN as a means of placing an invention before the people.

Very recently the inventors have hit upon a plan of simplifying the device, which practically amounts to a remodeling of the entire mechanism. This we illustrate herewith. By referring to the article relative to the earlier invention, the general capabil ties will be found in detail The device in brief is a miniature calculating machine, which does its work with unfailing accuracy and without requiring any thought on the part of the operator other than that involved in turning a disk to make coincidence between a figure and a letter. In shape the apparatus resembles a pencil, and its full size is shown in our engraving. It consists of a cylindrical case, closed above, and to the lower end of which is attached a circular flange, the upper side of which is numbered. Inside the hollow cylinder or case is a solid spirally grooved cylinder, and this carries at its lower end a milled disk which extends outside the flange, and is marked by a series of letters. The lower extremity of the pencil is merely used for pointing. The disposition of flange and disk will be more clearly understood from Fig. 2. In the groove of

Fig. 1

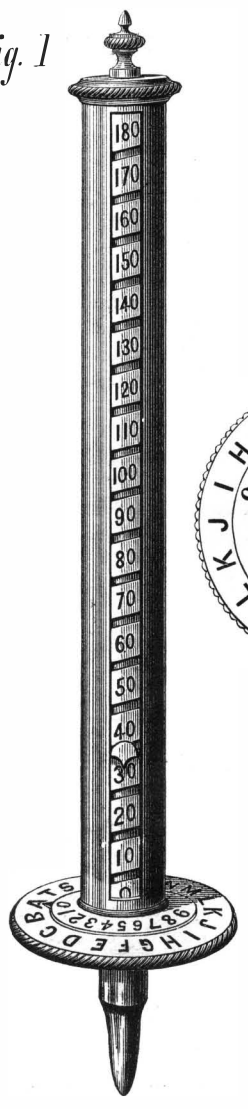
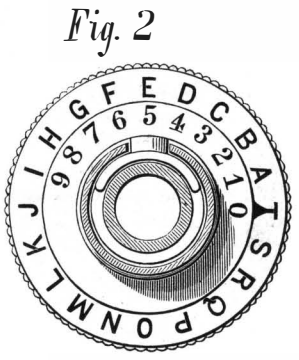


Fig. 2



the solid cylinder, which is numbered, is an index or traveler which projects through the longitudinal slot of the outer case.

Supposing the various parts to be disposed as in Fig. 1, the method of manipulation is as follows: The index, by rotating the inner cylinder, may be caused to travel up or down the slot; as shown, it stands at 30. To add, for example, 5, that number is first sought on the flange, and coinciding with it on the disk appears the letter, F. The disk is then turned by the thumb and finger until said letter F is brought to coincide with the zero mark. This, of course, at the same time rotates the solid inner cylinder so that a distance measured on the groove between the parts marked 30 and 35 travels beneath the index. The latter, therefore, ascends in the slot, and, when the movement is finished, remains pointing at 35.

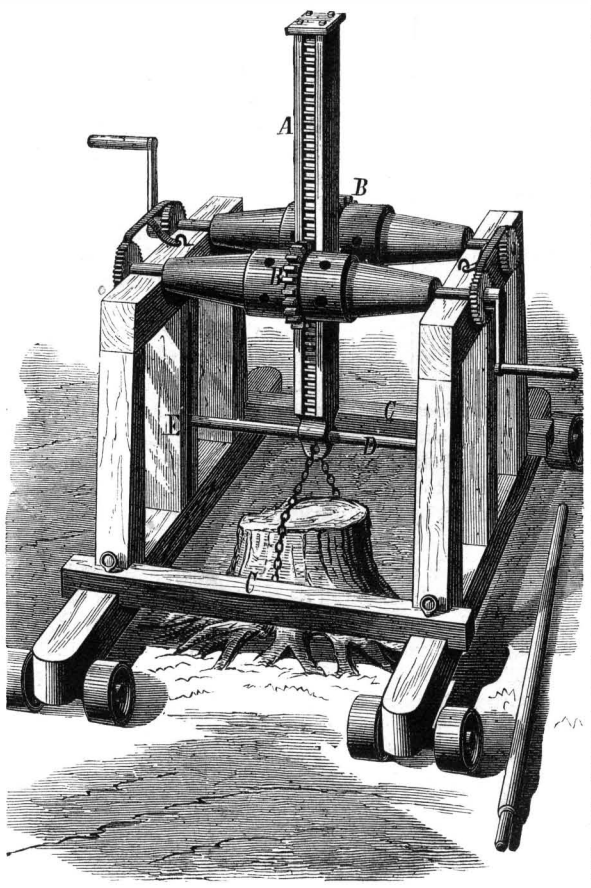
To add another number, the next in a long column, for instance, the letter which happens to corresponds thereto is as before carried around to zero, and this is continued until the column is finished, when the sum is shown by the index.

The advantage of the present over the older device is that the spring, rack, and cog wheel mechanism is abolished, rendering the pencil much cheaper, less complicated, and more reliable. It can be used about as fast as a good accountant can cast up a column of figures mentally; but time is saved from the fact that the first footing is always correct, and hence no second or check process is needed. The pencil can be used after very little practice. Interruption during the computation is no annoyance; and indeed the motion may proceed almost mechanically while the operator is engaged in conversation; or he may stop work in the middle of a column attend to other matters, and resume it after any period of time.

Patented through the Scientific American Patent Agency, April 4, 1876. Patents on improvements pending. The price of the pencil is $5, mailed free. For further information address the Adding Pencil Company, St Louis, Mo.

FICHT'S IMPROVED LIFTING MACHINE.

We illustrate herewith a new lifting apparatus well suited for pulling stumps, raising buildings, or similar heavy work. The power is applied to great advantage, and after the weight is raised it can be moved anywhere by the machine.

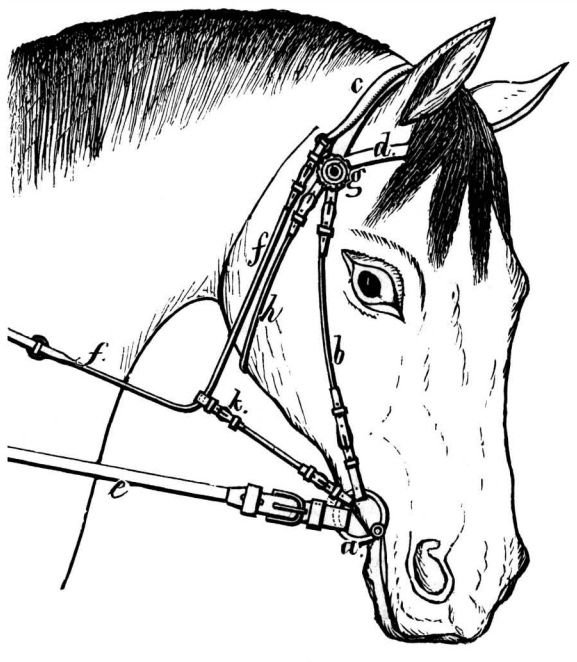


A is the lifting bar which is toothed on opposite sides and disposed between guide ribs, which keep it in gear with a couple of toothed wheels, B. These wheels are arranged on shafts journaled in the top of the supporting frame, which shafts are provided with ratchet and pawl-holding mechanism, and also cranks or levers (one of which is shown at F) for turning them. The frame is composed of two parts made of sills, posts, and beams, each mounted on trucks and detachably connected by cross beams, C, which are fastened by pins, so that the end parts of the frame may be separated to adjust the machine around a stump or other object to be raised. The lower end of the lifting bar has a guide rod, D, through it, and extending to guides, E, to prevent the bar from being drawn sidewise by the load. The latter is attached to the bar by the chains, as shown. The top of the lifting bar is adapted for placing underneath any load to be elevated. The manipulation simply consists in rotating the cranks, when the lifting bar is caused to rise.

Patented through the Scientific American Patent Agency, June 13, 1876. For further information address the inventor, August Ficht, Bella Sylva, Wyoming county, Pa.

IMPROVED CHECK REIN.

Mr. W. U. Selover, of Rahway, N. J., has invented an improved check rein, which is connected at its ends to the up



per part of the headstall, and passes through bit loops that are made of adjustable straps connected with the rings of the bit. By this construction the bit is not drawn forcibly against the upper portions of the horse's mouth. The movement of the head is free and easy, and there is no tendency to protrude the animal's nose, as is often the case when the check rein is drawn too tightly; and the check rein loops, being variable in length, can be adjusted to direct the pull of the check rein in any desired manner, and hence hold the head in the proper position.

The bit, *a*, is of the usual character. The side straps, *b*, head strap, *c*, front strap, *d*, and throat latch, *h*, are of the usual character, and the reins, *e*, are attached to the rings at the end of the bit. The check rein, *f*, is made adjustable in length in the usual manner; but the ends thereof, instead of being attached to the bit rings, are connected at or near the rosette, *g*, of the headstall, and at *k* are loops passing from the bit and around the check rein, so that said check rein may slide through these loops. These loops are, by preference, made as straps that are adjustable in length, and hence the place of intersection of the loops, *k*, with the rein, *f*, may be more or less forward or backward, and at any point the horse's head is free to swing up or down, but it is prevented from moving forward; thereby the animal's head is positioned so as to curve the neck gracefully and prevent him projecting his nose too far forward. The invention was patented February 8, 1876.

GAS WORKS ON THE KITCHEN RANGE.

Here is a device whereby any one may manufacture gas for his house with no more trouble than is taken in setting a clothes boiler on the range or cooking stove. Mr. John S. Thomas, of Maryville, Tenn., has patented the invention (June 13, 1876), through the Scientific American Patent Agency. It consists of a hollow cylindrical retort, A, Fig. 1, made of iron, with an iron cap, C, ground to fit the top. Over this cap there passes a strong iron ball, E, through which there passes a perpendicular screw pressing on the top of the cap, thus holding it firmly to its place. In this retort is to be placed fine or small broken bituminous coal. The retort is made to fit the hole of a stove, or it may be

Fig. 1.

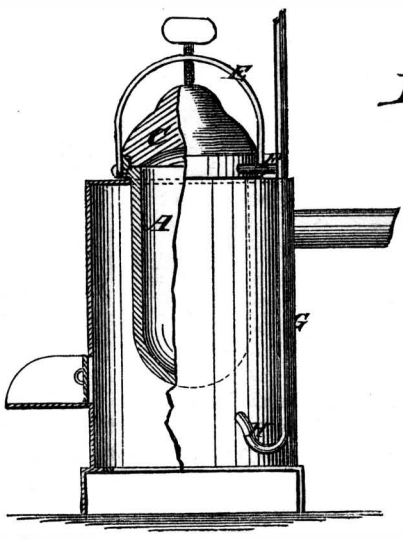
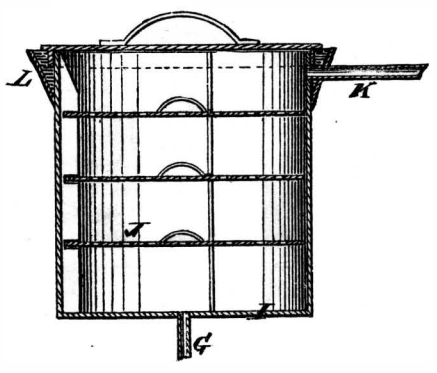


Fig. 2.



used in a furnace made for the purpose. From the retort and near the cap is a pipe, F, extending a short distance intersecting with a perpendicular pipe, G. At the intersection of these two pipes the gas and tar separate, the tar falling below into the tube, which descends below the bottom of the retort, on the outside of the stove, then crooks upward at H, and goes into the stove, fire, or furnace (the accumulation of gas and tar forcing it into the fire, and helping to create the heat necessary to manufacture the gas), or may be conducted elsewhere if desired.

The upper part of the pipe, from the intersection above mentioned, conveys the gas any distance that may be desired to a tin purifier, I, Fig. 2, which is packed alternately between sheets of perforated tin, J, made fast by catches to pieces fastened within, with lime and sawdust, or any material that will purify the gas. At the end from which the gas escapes there is applied a band, L, flaring from the body of the purifier, thus making a channel in which water is to be kept, and a lid, covering the main part of the purifier extending down into the water, prevents the escape of gas. From this purifier extends another pipe running into an ordinary gas reservoir, or it may be direct to a gas burner.

With this apparatus every family can manufacture their own gas, with which they can light their buildings, at the stove on which they cook their meals, in the fire or heater by which they warm themselves, or in the furnace made for the purpose, without any expense except for the apparatus with which it is manufactured, not even losing the heat with which it is made, but rather, on the contrary, utilizing it.

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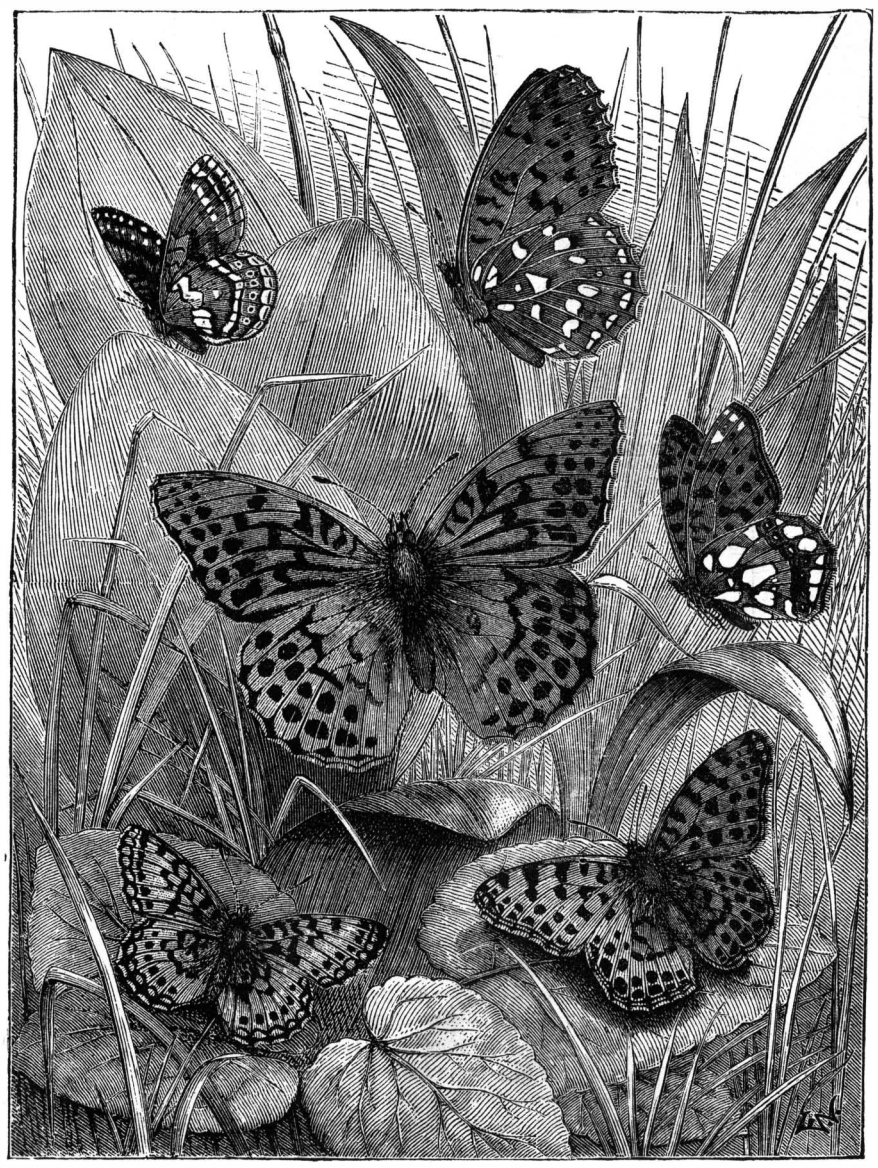
SOME WELL KNOWN BRITISH MOTHS.

Our engraving shows three specimens of moths, which resemble each other somewhat in the marking and color of the wings, but differ in size. The large one in the center is the privet hawk moth (*sphinx Ligustri*) which is nearly as common as the eyed hawk moth; its wings are brown, streaked or rather clouded with darker shades of brown, the hind are of a pinky color, with three black bands across them; the body is marked with brown and black in the center, and the sides marked with pink and black. The caterpillar is green, with seven pink stripes down the sides; the horn is black and green; it feeds on the privet or lilac bushes. The chrysalis is brown, and has a beak in front. The privet hawk moth appears about midsummer, and frequents woods and lanes. Sugaring is a good way to obtain this moth.

At the lower part of the picture on the left hand is seen the bedstraw hawk moth (*deiliphila Galii*), which is only locally known, but in the south of England it is by no means uncommon. The fore wings are brown, with a white line across the middle; the hind wings are pinky white, with a black margin. The thorax and body are of a uni form brown, with the exception of a few white lines on the sides of the thorax and on the end of the body. The caterpillar is green, with a pale line down the back, and a row of pale spots along the sides; the horn is a rusty red; it feeds on the bedstraw. The chrysalis is brown. The perfect insect appears in June or July; it fre quents lanes, and the downs near sea coasts.

The smallest of the three specimens, on the left hand in the engraving, is the small elephant hawk moth (*chærocampa porcellus*). The forewings are of a greenish shade, banded with pink; the hind wings are pink, but black at the base. The caterpillar is brown, with two conspicuous eye-like marks on the fourth segment; the first three segments narrow suddenly; this, together with the eye-like marks, give the caterpillar the appearance of a hog, hence the name *chærocampa*, or hog caterpillar. The caterpillar feeds on the willow herb or bedstraw. The perfect insect appears in June, and frequents lanes and the sides of brooks, especially where the willow herb is plentiful.

The reverse sides of the wings of the three specimens are shown by the flying moths in the upper part of the picture.



BRITISH MOTHS.

A Great Gold Mine that Runs as High as $100,000 to the Tun.

The American mine owned by Hiram Hitchcock, and superintended by Professor J. Alden Smith, is the most extensively worked in Sunshine district, Col. Ter., and for quantity and richness of ore one of the most wonderful mines in the world. The *Courier* says it is turning out large quantities every month, that sell to the smelters at from $100 to $6,000 per tun, and has paid large dividends constantly from the very commencement. The first class ore, by the tun, assays $5,000 to $12,000; the second class, about $800; and the third class, $200. Pieces can be picked from any of the first class sacks that will yield from $1 to $3.50 per ounce, or at the rate of $30,000 to $100,000 per tun. The quantity and quality of the ore has gradually but constantly increased from the surface, and now, at the depth of 220 feet, the vein is fully twice as large as it was at the surface, and the ore is far richer. From what is already known of this remarkable vein few will dispute the assertion that no mine thus far discovered has produced such extraordinary yields as the American at Sunshine. Its character under development proves it to be a true fissure, strong and exceedingly rich in precious metal. Its net returns at this time, and since the first ten feet of opening had been accomplished, have been and are greater than those of any other deposit of gold-bearing mineral in the country. Much of the crevice matter is worth from $10 to $40 per pound, and selected specimens have returned at the rate of $200 per tun. The Chicago *Inter-Ocean*, in speaking of this district, says: "But the latest mining sensation is the recent development in the Sunshine district of Boulder county. Tellurium has heretofore been found in only three localities in the world. It carries the richest deposit of gold. This species of ore is found in this district. Its yield is well nigh fabulous. The entire locality develops telluride ore, but among the discoveries the American mine has been worked to a demonstrable extent. The shaft is only down 220 feet, worked by a hoisting engine. The vein is 2 feet thick, of which a streak of 7 or 8 inches is pay ore. The first class of this is shipped to the Omaha Smelting Works, where the net sales average $5,050 per tun. To bring this price the ore has to assay $6,000 per tun, from which are deducted the freight charges, and $100 per tun for treatment; 90 per cent of the balance is paid to the owner of the ore. The getting out, sorting, and handling of the ore cost, when laid down in Omaha, $100 per month, freight inclusive. The mine employs 30 men, at a cost of $3,000 per month, who produce 20 tuns of milling ore in that length of time. Of this ore there is shipped, as first class, to Omaha, 2 to 4 tuns per month, and the balance to Professor Hill's works, at Black Hawk, as second class. The net profit of the mine is $40,000 per month. The present owners of the mine bought it, when partially developed, for $17,000. It cannot now be purchased at any price within reason.—*Miner's Journal.*

Brussels International Exhibition, 1876.

The Brussels International Exhibition, which was opened on June 26, is exclusively devoted to means or appliances for promoting health and public safety. It will be followed by a Congress, where all questions interesting to these subjects will be discussed, and, so far as possible, decided. A leading feature of this enterprise is that it has been started and sustained solely by private action. It received, however from its commencement the encouragement of King Leopold, who became a patron of this useful undertaking, and of his brother the Count de Flandres, who was elected the honorary President of the Central Committee.

The Exhibition was opened by the King of the Belgians with the usual solemnity. The exhibits are divided into ten classes, as follows: 1. Saving of life from fire; 2. Apparatus and engines of all kinds acting on water and in water, to diminish danger, prevent accidents, and give assistance; 3. Means of preventing accidents resulting from traffic on roads, railways, and tramways; 4. Means of assistance in time of war; 5. Public health; 6. Sanitary measures and means of saving life applied to industry; 7. Domestic and private hygiene; 8. Medicine, surgery. and pharmacy, in relation to the preceding classes; 9. Institutions for improving the condition of the working classes; and 10. Hygiene and protection of life as applied to agriculture. Each of these classes is subdivided into a certain number of sections.

The Russian department contains amongst other things a very complete collection o analyzed foods, such as are seen at South Kensington, showing their various qualities as human food. There are likewise a great number of plans and drawings showing various arrangements for schools, houses, public baths, etc., while the military staff has also sent a number of ambulance wagons, and surgical and medical appliances for use in war time.

Next comes the Belgian department. Here the Minister of Public Works exhibits reduced models of various life and tug boats, and other objects of the same kind, together with railway appliances, Amongst these we must notice an accident wagon, containing all that is necessary or useful in case of an accident occurring on the line, either by collision, fire, or by any other cause. This wagon is very good both in design and construction, and affords credit to M. Docteur, who has designed it and superintended its construction. The Grand Central Railway exhibits also some objects worthy of notice, among which are two carriages fitted with Maquet's *garde de corps*, for preventing guards from falling down when running along the train; this is rather of local interest, owing to the Belgian mode of collecting the tickets. A plan for warming the trains is shown by M. E. Belleroche engineer of the same company.

M. Waroque, the President of the Exhibition, and one of the richest coal owners in Belgium, exhibits a working model on a large scale of an apparatus called *Waroquiere*, from his own name, intended to raise and lower the workmen in the coal pits. There is also a direct-acting blowing or rather exhausting engine constructed by the *Société Anonyme des Atêliers de la Meuse*, under the direction of M. A. Stevart. This powerful engine, which has two cylinders of 6 feet diameter, is intended for the ventilation of coal mines, principally those troubled with noxious gases.

France comes next; but wonderful to say, this great country offers but few interesting exhibits, the greatest space being occupied by culinary and pharmaceutical articles, and those relating to dentistry. Near the French Department we find Sweden, Norway, and Denmark, and these sections, if they are not the most extensive, are certainly not in the least interesting of Exhibition. They relate principally to school buildings and furniture and houses for workmen.

Germany covers a great surface, and the exhibits are well arranged and useful. They include a good quantity of pumps and other machinery for saving life from fire. Plans and drawings showing the mode in which large public works have been conducted are numerous and very interesting, and the varied specimens in each of all the classes of the catalogue make this section specially worthy of notice.

Messrs. Siemens and Halske, the well known electrician engineers of Berlin, exhibit their numerous appliances for working railways under the block system, also their dynamo-electric machine with accessories. The ambulance wagons and cars, the medi cal and sanitary appliances to help wounded men in time of war, and to help them in all possible ways, are also very numerous and interesting.

In the Austrian department we find also a very complete assortment of ambulance wagons and cars, etc., even a complete train of eight carriages, the property of the Sovereign Order of the Knights of Malta. There is also a pretty good collection of maps showing the general arrangement of light-houses round the Austrian coasts.

Holland has also a good but small exhibition. In this naturally the greater portion is devoted to the means of protection against water. We must mention, however, specially the organization of the fire service of the city of Amsterdam, which is perhaps the most complete on the continent, all the stations being connected by a regular net of electric communication, which can be worked by the public as soon as a fire is perceived.

Italy has some curious exhibits, among which are several furnaces proposed for cre mation purposes. As a specimen of the merits of his *modus operandi*, one enterprising inventor shows a bottle containing a human body reduced to a weight of about 2 lbs.

At a right angle to this gallery is the British department. It covers a surface about equal to that of Belgium, and the exhibits are numerous and well chosen in all the different classses above mentioned. We shall briefly name *en passant* some of the exhibits most remarkable for their utility or their workmanship. Messrs. Saxby and Farmer have a splendid show, containing their various and well known appliances for railway signals, crossings, etc. The Brockelbank Syndicate demonstrate by a working model their system of wagon couplings, which attracts the attention of the public. The exhibit of the London committee for the second class is the most complete of the Exhibition in all respects. The Westinghouse Continuous Brake Company has only a drawing, illustrating the application of their system to an American and English train; but what is still better than a working model, they can show two trains in action on the State Railway lines, one which has now been running for three years on the Belgian railways, and the other fitted on their new automatic principle. —*Engineering.*

Steam Power for Street Cars.

Two separate trials were lately made in Edinburgh of Gran tham's patent tramway car, propelled by Shand, Mason, & Co.'s patent steam engine, with tubular boiler. The trials took place on the tramway rails of the Woodside Ferry and Hoylake Company. The car runs on a bogie with four wheels, the other end of the machine resting on two wheels. The latter being small, an acute curve is taken with facility. On a level part of the line the speed attained was not less than 14 miles per hour. The car can be stopped as suddenly as one drawn by horses. It is claimed for the engine referred to that it gives 12 horse power by a consumption of ½ cwt. of common gas coke per hour, or the work of 12 horses for 10 hours, at the cost of 5 cwt. of common gas coke, or less than $1.25. Out of fifty or sixty horses met by the car four of them shied on its approach. A small quantity of smoke was emitted from the funnel when the car stopped, and some when the steam passed through the safety valve.

The Excavations at Olympia.

The excavations which have been going on at Olympia, under care of the German government, are to be resumed in September. Many enteresting discoveries have been made in uncovering the ruins of the temple of Zeus, although has been only partially accomplished. It is inferred that

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the temple was destroyed by earthquakes, since whole ranges of columns have been overthrown together. These have been preserved from spoliation and decay by being covered with sand and clay; and the sanguine explorers almost think that the materials exist for rebuilding the façades. The bases of most of the columns, and frusta of some, remain *in situ*, as do also a portion of the pedestal of the statue of Zeus, some portions of the walls, and the bases of two altars in the aisles. The mosaic pavement, discovered by the French in 1829, has been re-examined, and covered again with sand to preserve it till work is resumed in the fall, when careful drawings will be made of it. Only the nave (so called) of the temple was paved with marble, the aisles being floored with stucco. A raised platform of about thirty by forty-five feet has been discovered in front of the eastern facade. It is encumbered by fallen columns, and has not been thoroughly examined. The statements of Pausanias concerning the dimensions of the temple agree with the measurement of the explorers, which prove that his were taken at the base of the lowest step on which the building stands. Two sculptured metopes have been found, one very well preserved and the other very ill. The Greek government, which takes great interest in the explorations, has stationed a detachment of troops at Olympia, and put the magazines under seal till the work shall be resumed.—*American Architect & Building News.*

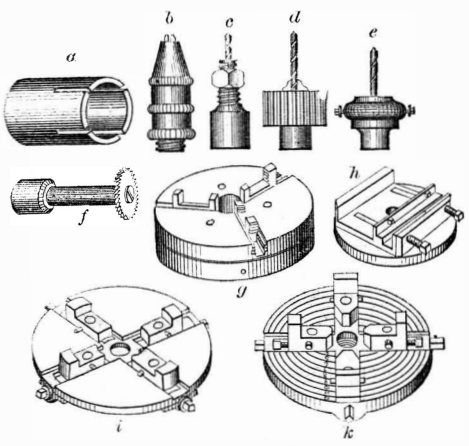
CHUCKS, FORMS OF IRON, AND LUBRICATORS.

Our extract from Knight's "New Mechanical Dictionary,"* for this week, includes an interesting series of illustrations of useful devices and forms of metal. The latter embody a very large number of sections of girders, beams, and other objects of iron, and the engravings will doubtless be found of utility for reference, in determining the selection of any especial shape desired for a particular purpose. Of

CHUCKS,

several improved forms are represented in Figs. 1 and 2. An expansion or elastic chuck, *a*, having a certain range of capacity, may be formed by giving a quadrifid cleft to the end of a cylindrical tube, whose other end screws on to the

Fig. 1.

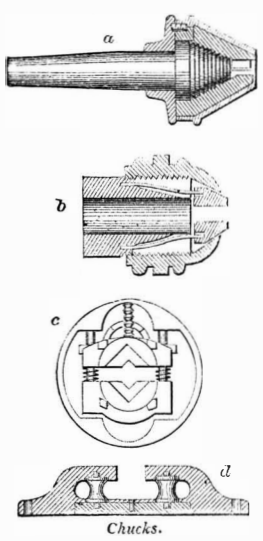


Expansion Chuck.

threaded mandrel of the lathe head. The object to be turned is thrust into the chuck, expanding the quadripartite socket. *b* is Beach's patent drill chuck. *c*, center drill chuck. *d*, Warwick chuck. *e*, Morse's adjustable chuck. A circular saw of small diameter may be mounted on a lathe chuck, *f*, which has an axial tenon to fit the hole in the saw, and a central screw or nut to fix the same. *g* is a scroll chuck with three radially adjustable dogs. *h* is a planer chuck. *i* is a screw chuck. *k* is an independent jaw chuck.

Fig. 2 shows three forms of lathe chucks having jaws to grasp the tool or the work, as the case may be. In *a* the stock of the chuck terminates in a conical, threaded head, which opens or closes the jaws, which are threaded, and slide in grooves in the conical shell. The nut in *b* has a conical opening in the end which operates against the inclined backs of the jaws, to clamp them upon the drill; when relieved they are expanded by springs. The chuck, *c*, belongs to that class which is constructed with screws for the purpose of operating the jaws. It is provided with a double screw, the pitch of one being just half that of the other, to operate the jaws simultaneously in opposite directions, so that they will approach or recede from the center at equal speed, thereby forming a self-centering mechanism. *d* is an entirely different device though having a similar name. It is a warping chuck, in which hawsers or ropes run. Friction rollers prevent the wearing of the rope. It is used on the rail or other portion of a ship's side.

Fig. 2.

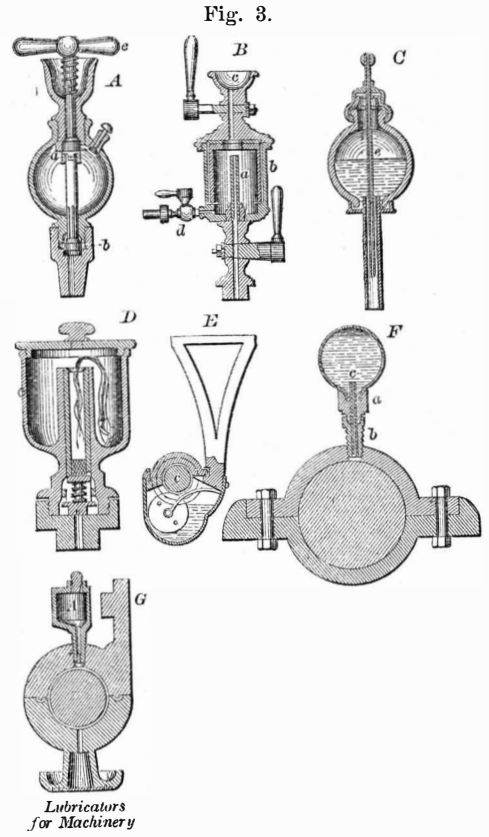


Chucks.

LUBRICATORS,

designed for supplying oil or grease to rubbing surfaces in order to diminish friction, are represented in Figs. 3 and 4. In A, Fig. 3, the two valves, *a b*, are connected by a rod. By turning the handle, *e*, in one direction, the valve, *a*, is depressed by means of a pin working on an inclined plane, and admits oil to the reservoir. A reverse motion opens the valve, *b*, furnished with a similar contrivance, permitting the oil to flow from the reservoir. The valve, *a*, is kept to its seat by a spiral spring on the rod. In B, steam is admitted through the pipe, *a*, to the oil chamber, *b*, forcing out the lubricating material through an opening to the desired point. The supply of oil from the cup, *c*, is regulated by a cock, and a cock, *d*, at the side of the oil chamber permits accumulating water of condensation to be drawn off. In C, the central tube, *e*, is open, and, when the oil sinks below its lower end, air is admitted through it and the annular passage

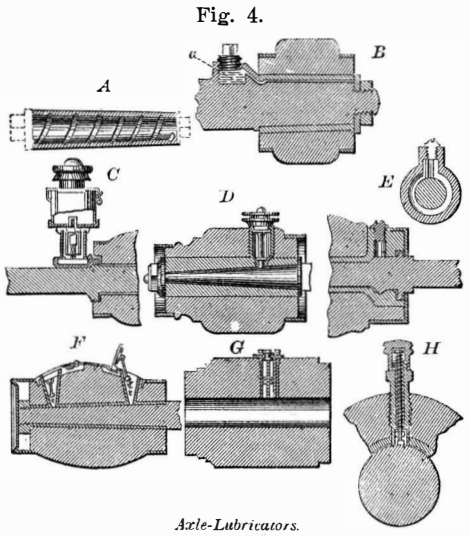
Fig. 3.



Lubricators for Machinery

to the reservoir above, and allows an equivalent amount of oil to descend. The vertical adjustment of the tube regulates the flow by determining the hight of the column of oil resting upon the journal. In D the oil is conducted from the annular reservoir by a wick of fibrous material into the tubular valve stem. This stem has radial holes at its lower end for the discharge of oil, and wire gauze to arrest impurities. Between the upper and lower valve is a spiral spring. When the engine is running, the valves are closed by steam and spring pressure; when stopped, the upper valve is closed by the spring, and when running without steam both valves are sucked open and the oil flows. E is designed for shafting. A pivoted disk in a cup below the lower journal box is revolved by contact with the under side of the shaft, *c*, and carries up oil to lubricate the latter. F has a transparent reservoir with metallic socket, *a*, screwing into the seat, *b*, fitted to the cap of the journal box. Between this and the journal is a slight vacuity, from which air is admitted through the tube, *c*, allowing a greater or less quantity of oil to flow in proportion as the journal turns more or less rapidly. When at rest the flow ceases. The flow of oil from the cup, A, in G, is regulated by an adjustable screw plug. The bearing has ducts for conveying surplus oil from the upper part of the shaft toward the center, and at its lower part is a closed chamber forming a drip cup. In Diller's (A, Fig. 4), a spiral groove is formed around the inner surface of the box, and leads the grease to all parts of the spindle, while the integrity of the bearing surface of the box is not materially interfered with. The reservoir, *a*, in B, is closed

Fig. 4.



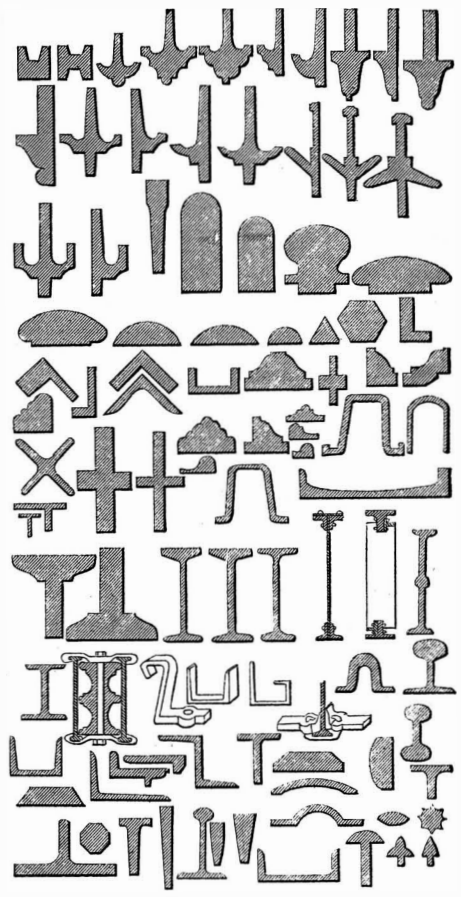
Axle-Lubricators.

by a screw plug, which is turned to force the oil through a duct leading to a groove in the upper part of the spindle. The groove tapers toward the outer end, so as to distribute the oil equally. In C a lantern is attached to the axle of the carriage just inside of the butting ring. The oil reservoir, besides furnishing supply to the wick of the lantern, also supplies oil through a duct to the bearing surfaces. In D a tube passes radially through the hub, its lower end opening into the interior space of the box. The oil reservoir is covered by a screw cap. The inner end of the tube is closed by a valve whose stem is attached to the cap. By turning the screw cap the valve is opened or closed, and the oil is allowed to flow, or is cut off. E has an oil chamber made in the box, which communicates with the bearing surfaces. The reservoir is closed by a screw plug, and the oil passes gradually to the spindle without special attention. In F there are one or more conical openings in the hub, each closed by a spring lid to which a rod and sponge are attached, extending to the axle. The sponge is charged with oil on opening the lid. This is kept shut by the spring when the wheel is in motion. G has an oil cylinder, having a piston on a screw rod which works through the cylinder cap, inserted in the hub. Turning the head of the rod pushes the piston down, forcing the lubricant upon the axle spindle. The piston is kept from rotating with the screw cap by a groove in its edge, into which a feather on the inside of the chamber fits. In H the depression of the spring valve allows oil to flow from the chamber to the spindle of the axle.

THE FORMS OF IRON

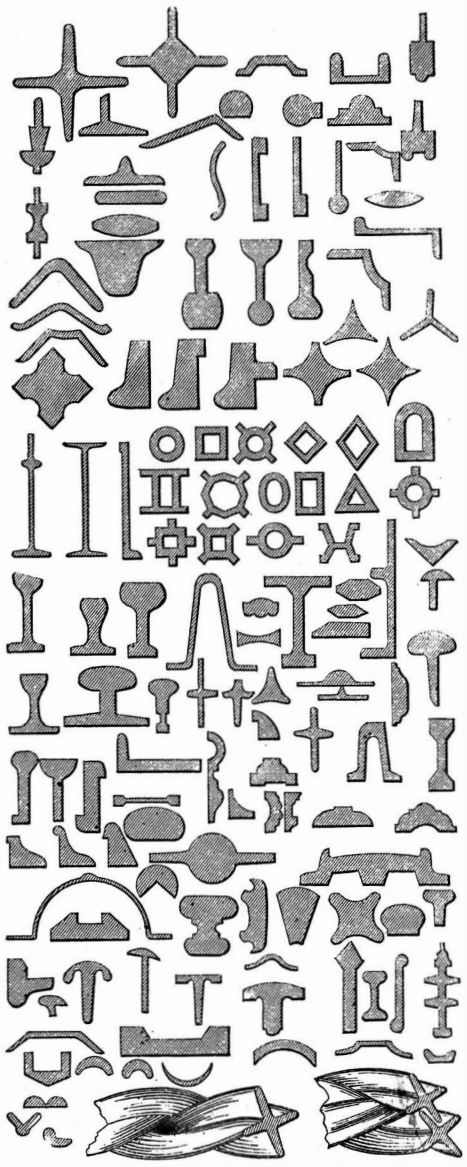
are simply sections, as already stated, and are illustrated in

Fig 5.



Angle, Bar, Girder, and Rail Irons

Fig. 6.



Angle, Bar, Girder, and Rail Irons.

Figs. 5 and 6. The shapes are already shown and need no explanation.

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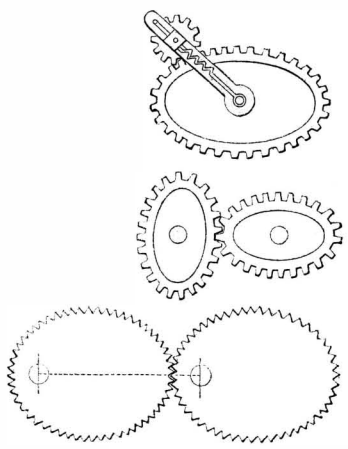
In Fig. 7

ELLIPTICAL WHEELS

are represented. These are used where motion of varying speed is required, and the variation is determined by the relation between the lengths of the major and minor axles of the ellipses. In the upper figure variable rotary motion is produced by uniform rotary motion. The small spur pinion works in a slot cut in the bar, which turns loosely upon the shaft of the elliptical gear. The pinion is kept to its engagement by a spring on the shaft. The slot in the bar allows for the variation of length of radius of the gear.



Elliptical Wheels.

THE INDUSTRIES AND RESOURCES OF JAPAN.

Japanese manufactures are of great interest to foreigners, primarily in consequence of the raw materials (often unknown in other countries) of which they are made, and secondly on account of the various processes used in their production, processes invented in the long course of patient manual labor, which left to each artisan a free field for his exertions to simplify his work or to produce some new and original object.

With reference to the social condition of industry, it should be stated that there are but very few workshops, of any size or importance, giving employment to more than 30 or 40 persons, and that in most places the manufacturing is done on a small scale. Heavy machinery, with the exception of water wheels, is not used; but the hand tools are in general very well adapted for their purposes; and in several branches of industry, such as, for instance, in fan making, in the manufacture of porcelain, etc., the division of labor is carried on to a great extent. Of later years not only the government, but also the private people, have made great efforts to create larger industrial establishments. Several paper mills have been erected in Tokio, Kiyoto, and Osaka; cotton mills, silk-reeling establishments, with steam or water power, are to be found in different places; a glass furnace has been built in Tokio; sulphuric acid works in Osaka; soap manufactories are at work in Tokio and other places. The streets of Yokohama and of a great part of Tokio are lighted by gas made of the coal mined in Milike, province of Chikuzen; several machine shops and gun manufactories have been established by the government in Tokio, Osaka, Nagasaki, and the arsenal of Yokoska is very completely organized for the purpose of shipbuilding. At the same time, more liberty has been conceded to trade in general, and the old restrictions have been abolished without producing any of those perturbations which have so frequently taken place in Europe in consequence of reforms effected in connection with the social condition of industry.

To these remarks of general character we now extract some special notes concerning the various industries of the country, from the official Japanese Centennial catalogue, limiting our observations either to some characteristic features of a technical kind, or else only pointing out the peculiar nature of the raw materials used in the manufacture of the articles exhibited.

CHEMICALS.

Salt is used in large quantities for the ordinary food, and the preservation of fish and vegetables. It is exclusively produced from sea water by solar evaporation in large salt gardens, composed of a series of fields, the soil of which has been hardened and afterwards covered with a layer of sand. The clean sea water, flowing in through a perfect network of small ditches, is sprinkled over the fields by the workmen, the operation being repeated three times at intervals of a few hours. The sand is then raked together and carried for lixiviation to the filters, which consist of small square wood tanks, 4 by 4 inches, having a bottom of bamboo, covered with straw and mattings. The concentrated lye running out from these filters is first stored in covered wells, and then brought to the evaporating pans through wooden pipes. These pans are not always of the same construction. In some places they consist of low vaults, built of large pieces of slate, covered with gravel and mud, so as to fill up the interstices, and to form the bottom of the pan, which is surrounded by a low mud wall. This vault has an opening on one side for the insertion of fuel, and another on the other side leading into the flue

In other places, a very curious kind of a pan is used, which is constructed in the following manner: A low wall is built, enclosing a space of 13 by 9 inches, the bottom forming a kind of prismatical depression, 3 inches deep in the center. An ash pit, 3 feet deep, is then excavated, starting from the front wall, and extending about 4 inches into this depression at its deepest place; it communicates with the outside by means of a channel, sloping upwards, and passing underneath the front wall. The ash pit is covered by a clay vault, with holes in its sides, so as to establish a communication between the ash pit and the hollow space under the pan. This vault is used as a grate, the fuel (brown coal and small wood) being inserted through a door in the front wall. The air draft necessary for burning the fuel enters partly by the fire door, partly through the ash pit, and the openings left in the vaulted grate. Through these same openings the ashes and cinders are from time to time pushed down into ash pit, for which purpose small openings are left in the side wall of the furnace, through which the rakes may be introduced. A passage in the back wall, supporting the pan, leads off the results of combustion and the hot air into a flue gradually sloping upwards, and ending in a short vertical chimney. At the lower part, some iron kettles are placed in the flue for the purpose of heating lye before it is ladled into the evaporating pans. With reference to the pan, it is made in a way which requires a great deal of skill and practice. In the first place beams, reaching from one side to the other, are laid upon the top of the furnace walls, and are covered with wooden boards, forming a temporary floor. Two or three feet above this floor a strong horizontal network of wooden poles sustain a number of straw ropes, with iron hooks hanging down, and of such length that the hooks nearly touch the wooden floor. The floor is thereupon covered with a mixture of clay and small stones, 4 to 5 inches thick, the workmen being careful to incrustate the iron hooks into this material. It is allowed to dry gradually; and when considered sufficiently hardened, the wooden beams and flooring are removed with the necessary precautions. The bottom of the pan remains suspended by the ropes. The open spaces left all around, between the bottom and the top of the furnace walls, are then filled up, and the border of the pan, 9 or 10 inches high, is made of a similar mixture. It is said that this extraordinary construction lasts 40 to 56 days when well made, and that it can be filled 16 times in 24 hours, with an average of 500 quarts of concentrated lye at each filling. The salt, when removed from the pan, is placed in baskets, so as to allow the adhering lye and part of the deliquescent impurities to drip off; afterwards it is spread out with a layer of sand underneath. in order to dry. The purity of the salt, which differs in quality, depends upon this last treatment.

OILS, SOAPS, ETC.

The oil ordinarily used in Japanese households is the rapeseed oil, produced from the seeds by heating, crushing, and finally pressing them with a kind of roughly made wedge press; in short, it is prepared by a series of operations similar in principle to the European processes. The lamps are merely flat saucers, and the wicks consist of two or three pieces of the white and soft pith of the *juncus effusus*, which are laid into the saucer, and lighted by the end projecting above the edge of the vessel.

But the most important article for illuminating purposes is the candle made of vegetable wax, which is mostly composed of palmitine. It is produced from the fruit of several trees belonging to the genus *rhus*, among which the *rhus succedanea* is the most important, and is grown among vegetables, more or less extensively, almost everywhere in Japan, especially in the western provinces, from the south northwards to the 35th degree. The lacquer tree-*rhus vernicifera*, also yields wax, and differs in appearance but little from the wax tree; its geographical limit extends further northwards, being at the 38th degree. Finally the *rhus sylvestris*, or wild wax tree, should be mentioned. The cultivated wax tree was originally imported from the Loo-choo islands; but the growers of the tree now distinguish seven different varieties. The berries, of the size of a small pea, and united in bunches, contain the wax between the kernel and the outer skin; they are crushed, winnowed, steamed, placed in hemp cloth bags, steamed again, and afterwards pressed in a wooden wedge press, all by hand. In order to facilitate the flow of the wax, a small percentage of *pe no abura* (oil from *perilla ocimoides*) is added. The raw product, of a greenish color, is made into square cakes, and reduced to small scraps by means of a kind of planing tool, then washed and bleached by the sun and air, whereupon it assumes a pure white color. In ordinary candlemaking the unbleached wax is used, and the manufacturing is done by repeated dipping and rolling on the flat of the hand, in order to smooth and harden the successive coatings. The wicks are made by rolling a narrow strip of Japanese paper in a spiral line around the upper part of a pointed stick, and twisting it at the upper end, so as to prevent its getting loose. Two or three strings of the pith of *juncus effusus* are then rolled around this paper, in close spiral lines, and fastened with a few fibers of silk waste, so that the wicks can be taken off from the stick, and sold in bundles to the candle maker. The latter places the wicks again on sticks, takes half a dozen of them in his right hand, dips the wicks into the melted wax, and rolls them upon the palm of the left hand, repeating these operations till the candles have grown to the proper size For the outside coating, occasionally white wax is used. These candles are made of all dimensions; for ceremonies and similar occasions candles of bleached wax are used, of a fanciful shape and painted with bright colors. The art of candle making is said to have been introduced from Loo Choo, towards the end of the 16th century. Before, this time pieces of resinous wood or paper dipped in oil were used.

Another tree yielding a kind of vegetable tallow is the *cinnamomum pecundulatum*. This, however, is seldom cultivated, as, in consequence of its being an evergreen plant, it would cast too much shadow on the other plants cultivated underneath.

An insect, producing a kind of wax very much like or perhaps identical with the Chinese *pela*, lives upon the *ligustrum Ibota*. The insects, in clustering round the thin branches, form by their secretions lumps of a slightly transparent white wax, of a crystalline construction and a very high melting point

A very fine oil is extracted from the seeds of a certain species of camelia, and, either flavored or unflavored, is used for the hair or for pomades, which consist of a mixture of camelia oil and vegetable wax.

PAINTS, PIGMENTS, VARNISHES, ETC.

The most interesting product appertaining to this class is undoubtedly the Japanese lacquer (*urushi*), celebrated all over the world for its excellent quality and great beauty This valuable article is almost entirely a product of Nature and requires but a few mechanical operations to be ready for use. It consists merely of the sap of the *rhus vernicifera*, which is cultivated especially for the production of lacquer, chiefly between the 33° and 37° of N. latitude. The trees when 5 years old are regularly tapped from the end of May until the end of October, incisions being made in the bark, extending about one quarter of the trunk's circumference, and just deep enough to reach the wood. On the incision being made, clear sap flows out, mingled with a very white milky substance, which darkens very soon when exposed to the air, and gradually assumes a dark brown and almost black color. At first these incisions are made at about 14·04 inches distance one from another, on alternate sides of the trunk, and the lacquer is taken off with an iron spatula as soon as it has filled the incisions. After an interval of three or four days new incisions are made, close above and below the former cuttings. Proceeding in this manner until the end of the season, the whole tree becomes covered with incisions, and has to be cut down. The branches are lopped off, soaked in water, and also tapped, by means of incisions made in a spiral line. The lacquer taken from the branches becomes very hard, and is therefore mostly used for priming; its name is *seshime urushi*. In the more northerly part of Japan, where the lacquer tree is cultivated with the additional view of producing wax, the tapping is done on a small scale only, so that the tree need not be cut down, but may yield lacquer and wax for a number of years.

The quality of the crude lacquer (*ki-no-urushi*) depends upon the season in which it has been tapped, and also upon the circumstances of climate and soil, as well as on the care bestowed on the cultivation of the tree. The raw produce is a viscous liquid of a dirty gray color, always covered with a dark brown skin where it comes into contact with the air, and mixed with particles of the bark of the tree and other accidental impurities. Having been placed in small wooden tubs lined with paper, it is allowed to settle gradually; the produce separates into a thinner and finer quality in the upper half, and a thicker and less good quality which settles in the lower half, of the tub. Both are separated by decanting, and are strained through cotton cloth. The superior quality of lacquer is stirred in the open air in order to allow a certain excess of water to evaporate, after which process it assumes a brilliant dark brown or nearly black color; in thin layers it appears transparent, with a brown color similar to that of shellac. The further operations which the lacquer undergoes before being ready for use are generally effected by the workman himself before using it; they consist of mixing it with powdered snbstances, with a view of either hardening or coloring it, and of straining the pure lacquer, or the mixture, through a peculiar long-fibered paper called *yashino-gami*, made for this purpose. The *shunkei urushi*, a kind of lacquer which has to undergo no grinding or polishing, and which is supposed to acquire sufficient brilliancy by mere hardening, is made by mixing the pure lacquer with a small quantity of the *ye-no abura* mentioned above. This lacquer is used in a manner similar to the foreign shellac or copal varnishes for furniture, upon which it forms a brilliant transparent coating of a yellowish tint, through which the veins of the wood remain visible.

A most interesting operation is that by which the celebrated black laquer (*roiro-urushi*) is produced. This is effected without the addition of any solid particles, such as lampblack or similar substances, but merely by stirring the crude lacquer for one or two days in the open air, whereupon it assumes a very dark brown color. Towards the end of the operation a small quantity of water, which has been allowed to stand for a few days mingled with iron filings, or a gall nut infusion darkened by the addition of iron is added, and the whole stirred again until part of the water has evaporated, whereupon the lacquer acquires a proper consistence and color. The addition of this water is said to be absolutely necessary for producing the highest brilliancy and darkness of the lacquer. The operation as described above is indispensable; but there are a few unimportant modifications, since the manufacturers sometimes add a solution of gamboge or a decoction of the yellow fruits of *gardenia florida*, or other liquid dyestuffs, for the purpose of improving or modifying the color of the varnish.

Among the peculiar properties of lacquer it may be mentioned that it is rather poisonous, and often produces eruptions on the skin, or swollen faces, or headaches, etc.; however, the effects are not the same upon all persons; most people get accustomed to it, others are not affected at all by it. The manipulations of coating and painting with lacquer will be described in another article.

Japanese writing inks are very much like Chinese, and manufactured in a similar, though perhaps not quite identical, way. The body of the ink is soot, obtained from pine-wood or rosin, and lampblack from sesasum oil for the finest sort. This is mixed with liquid glue made of oxskin. This operation is effected in a large round copper bowl, formed by two spherical calottes placed one inch apart, so that the space between can be filled up with hot water to prevent the glue from hardening during the time it is mixed by hand

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with the lampblack. The cakes are formed in wooden molds and dried between paper and ashes. Camphor, or a peculiar mixture of scents which comes from China, and a small quantity of carthamine (the red coloring substance of safflower) are added to the best kinds for improving the color as well as for scenting the ink. There is a great difference both in price as well as in quality of the various kinds of ink, the finest article being rather costly. The most renowned manufactory is in Nara, the old capital of Japan, in the province of Yamato.

[For the Scientific American.]

THE OCEANIC CIRCULATION CONTROVERSY.

The question as to whether the circulation of the ocean is due to winds or to gravitation is one that is now widely and warmly discussed. Most of this contention seems to collect around two men as nuclei: one is Mr. James Croll, who holds to the wind theory, and the other Dr. W. B. Carpenter, who attributes circulation to the opposite effects of tropical heat and arctic cold. The effect of winds upon the surface of water is far from inconsiderable. We can see this from the results observed on our eastern coast. "It is well known," says Professor Newcomb, "that the tides are there materially modified by the winds, so that the time of high water may be delayed or accelerated by an entire hour or more, and the hight changed by one or more feet in consequence of a heavy wind. The effects of a wind thus determined must be the same as that of a difference of level equal to that which the wind is found to produce, and this again must be sufficient to produce a very strong surface current. Moreover, a continuous surface current must, in time, extend itself to a great depth, through friction." On a long sloping beach, the wind is often known to blow the water seaward to such an extent that ships at anchor near the shore in high tide, instead of being able to set sail in a succeeding high tide, have been left on a dry beach. In the passage of the Israelites through the Red Sea, we are told that "the Lord caused the sea to go back by a strong east wind all that night, and made the sea dry land." Observations in connection with the survey of the Suez Canal route have revealed the fact that at the probable place of crossing was a sand bar, but a little beneath the surface, which is now visible above the surface. The strong east wind was sufficient to force back the water from this sand bar and make a dry passage way. So this statement of Scripture is in strict accord with the discoveries of science.

On the other hand, adherents to the gravitation theory hold that, as water is heated by the sun at the equator, and cooled by want of it at the poles, the cold and hence heavier water of the north must sink and crowd under the warmer and lighter water at the equator, thus causing circulation. The movement-forming currents in the air are explained on the theory that the heavy air descends, crowding up the air made lighter by the expansive power of heat. The result of this is seen in the northeast and southwest winds from the poles to the equator, and the probable upper currents in the opposite direction. This is the accepted explanation of atmospheric circulation; and since the water—though less mobile—is nearly a perfect fluid, the same cause would reasonably be expected to produce a similar effect in the ocean. While these two theories, when simply stated, seem almost equally plausible, the friends of each find many objections to an acceptance of the other.

Much has been said about the Challenger's "crucial test" of these opposing theories. This has been advanced by Mr. Croll in opposition to the gravitation theory. Mr. Croll rightly remarks that, for gravitation to act, the surface at the equator must be elevated above that at the poles and all intermediate points. By referring to Dr. Carpenter's oceanic section which is most favorable to the latter's theory—which section is remarkable for the thinness of the warm strata at the equator compared with the greater thickness of the heated water in the North Atlantic—he concluded that the ocean, to be in equilibrium, must stand at a higher level in the North Atlantic than at the equator. To verify this conclusion, Mr. Croll examined the temperature soundings of the Challenger expedition taken near the equator, in 23° and 38° of north latitude; and he computed the variation in the hight of these three columns of water due to the temperature indicated, by the use of Muncke's table, showing the expansion of sea water for different degrees of temperature. He afterwards corrected his computations by comparing them with results obtained from the use of Hubbard's table, and found that the column of water at 23° north latitude must stand 2 feet and 3 inches, and at 38°, 3 feet and 3 inches, higher than at the equator, in order to produce equilibrium. This shows that the north latitude waters must stand higher than the equatorial, and that in fact the surface does slope up from the equator to nearly the latitude of England. Hence, if the circulation from the equator to the pole is due to gravitation, the water must literally run up hill. And Mr. Croll says we might as soon expect the waters of the Gulf of Mexico to flow back into the Mississippi and Missouri rivers by force of gravitation.

From the data Mr. Croll has given from the records of the Challenger, it is somewhat difficult to see how he reaches his conclusions. For, taking the temperature soundings as he has given them, and finding the mean of temperature for the three latitudes above mentioned, we find the mean temperature of the water columns for the soundings to be a little over 51° at the equator, nearly 45½° in latitude 23° north, and about 46° in latitude 38° north. According to this, to produce equilibrium, the column would necessarily be highest at the equator, because expanded by greatest amount of heat, next highest at latitude 38°, and lowest at 23°. Hence there would be a depression in the surface, and then an elevation as we go from the equator to the pole; but as the equatorial surface is higher than the elevation north of it, the force of gravitation could doubtless cause a northerly flow to the surface water. This result, however, does not suit Mr. Croll's purpose, and is evidently not the one which he obtained, though, as far as we can see, legitimately and naturally reached by use of his own data. But if we take in each of the three columns (representing the three latitudes) the mean temperature of only those soundings which correspond in depth in all columns, we obtain results just suited to Mr. Croll's purpose, which represent conditions essentially alike those which he presents as necessarily existing from Dr. Carpenter's section and the Challenger's soundings, namely, 42° at equator, 45° at latitude 23°, and 46° at 38°, or a gradual elevation of surface from the equator to the North Atlantic. This is presumably the method of calculation by which he reached his conclusion.

Mr. Croll further notices that Dr. Carpenter's section south of the equator furnishes an argument for the wind rather than for the heat theory. This section reveals the fact that the amount of warm water north of the equator is much greater than south of it, while, according to the heat theory, the reverse should be the case, because of less obstruction to circulation south than north of the equator. Dr. Carpenter anticipates this objection by explaining that the warm water is in excess north of the equator because "the upper stratum of the North Atlantic is nearly as much cooled by its limited polar outflow as that of the South Atlantic is by the vast movement of antarctic water which is constantly taking place toward the equator." "But," answers Mr. Croll, "this 'vast movement of antarctic waters' necessarily implies a vast counter movement of warm surface water. So that if there is more polar water in the South Atlantic to produce the cooling effect, there should likewise be more warm water to be cooled." Mr. Croll declares this fact is easily explained on the wind theory, by noting the fact that the southeast trade is stronger than the northeast, and hence, by overpowering the northeast trade and blowing across the equator, would sweep the preponderance of warm water into the Gulf of Mexico, where it has time to be heated, and then to the north, where it accumulates.

Mr. Croll is apparently a little inconsistent in the following: "There is an additional reason to the one already stated why the surface temperature of the South Atlantic should be so much below that of the North. It is perfectly true that whatever amount of water is transferred from the southern hemisphere to the northern must be compensated by an equal amount from the northern to the southern hemisphere; nevertheless, the warm water which is carried off the South Atlantic by the winds is not directly compensated by water from the North, but by the cold antarctic current, whose existence is so well known to mariners from the immense masses of ice which it brings from the Southern Ocean." So it is not directly compensated from the north at all, but from the south. And, from all he says, we might expect a constant accumulation around the north pole at the expense of the south. If it is not directly compensated from the north, how is it indirectly? While Mr. Croll leaves us in the dark respecting this important question, we find an explanation in Professor Wyville Thomson's Challenger "Report to the Hydrographer of the Admiralty.' He says: "The more the question is investigated, the less evidence there seems to me to be of any general ocean circulation depending upon differences of specific gravity. It seems certain that both in the Atlantic and Pacific the bottom water is constantly moving northwards; and I am now very much inclined to refer this movement to an excess of precipitation over the water hemisphere, a portion of the vapor formed in the northern hemisphere being carried southwards and precipitated in the vast southern area of low barometric pressure." Want of space forbids remark on this explanation.

Mr. Croll again notices, from Captain Nares's report of Challenger Expedition, that, from 50° to 65° of south latitude, water to the depth of 600 fathoms—excepting a thin stratum at the surface heated by the sun's rays—was several degrees colder than the water below it; and declares this entirely inconsistent with the gravitation theory, according to which the colder should sink beneath and displace the warmer. Carpenter answers this quite satisfactorily by saying the cold water, according to Captain Nares's distinct statement, comes from the melting of field ice, and would have less salinity, hence less specific gravity, than the salt though warmer water beneath. The truth of this, however, depends upon mathematical computations from well ascertained data, and not upon theory.

To Mr. Croll's first crucial test argument, Dr. Carpenter at first replied that the doctrine to which Mr. Croll applied his test was a creation of his (Croll's) own, since his whole argument was based on the assumption that the ocean was in a state of static equilibrium, whereas Carpenter claims that it never can be in equilibrium so long as part of it is cold and the other part warm. And he illustrates it by a boiler and water pipes for heating, and claims that equilibrium exists till heat is applied, and then can exist no longer, and circulation necessarily commences. In one of his communications later in the series, Dr. Carpenter replies, as if it were an afterthought, that Mr. Croll "has entirely omitted the consideration of the inferior salinity of the equatorial column." This, he says, would make a difference in the opposite direction sufficient to neutralize the three feet and over of excess in the elevation of the North Atlantic column of water. To Dr. Carpenter's former point, Mr. Croll replies that considering the ocean in equilibrium was an advantage in his opponent's favor: the former granting that it never attains such a condition, and that, on the latter's supposition, a disturbance of equilibrium would necessitate that the North Atlantic elevation above the equatorial surface be greater than Mr. Croll has computed, and hence so much less liability for the water to move to the north by its weight. "It is singular," says Mr. Croll, "that Dr. Carpenter should not have observed that his objection strengthens my argument instead of weakening it. For if it be true that the equatorial column, though in a state of constant upward motion, never attains to the hight required to balance the polar column, then it must follow, as a necessary consequence, that the rise from the equator to latitude 38° in the North Atlantic must be greater than I have estimated it to be; and therefore, so much the more impossible is it that there can be any surface flow from the equator to the pole due to gravity." There seems to be a little want of candor or some misunderstanding in this reply; for it supposes the lack of equilibrium to result in a movement of surface water from the north toward the equator; and neither partly believes this the true direction. Mr. Croll's strong point seems to be that water will not run up hill by the force of gravity. But if the North Atlantic is over three feet higher than the equator, why does it not run down hill by force of gravity? Or, since it is in equilibrium as it stands, is it not as likely to run one way as the other?

Respecting Dr. Carpenter's latter objection, Mr. Croll expresses doubts as to the inferior salinity of the equatorial column to any great depth, though granting it to be a fact as far as the surface is concerned, and claims this as additional evidence in favor of his theory; but in what way, he fails to make clear, especially when he afterwards admits that he has made allowance for differences in salinity, to the advantage of the other theory.

There has been considerable sparring between the opposing parties concerning the viscosity of water in its effects upon this question; but while one concludes that it has nothing whatever to do with the question at issue, the other says that it is so slight that it may well be entirely ignored. Hence the *pro* and *con* on this point need not be noticed.

After the long and determined controversy, which is here but briefly epitomized, it seems a little strange that each has virtually admitted the correctness of his antagonist's position. Mr. Croll remarks: "Everyone will admit that, were there no other agencies at work but equatorial heat and polar cold, a difference of temperature would soon arise which would induce and sustain a system of circulation, but this condition of things is prevented by the equatorial waters being swept away by the winds as rapidly as they are heated." To this, we would simply remark: There appears no good reason why "this condition of things" should be "prevented" by the winds, and might not exist in its degree at the same time. On the other hand, Dr. Carpenter asserts: "I have never denied the existence of a horizontal wind circulation." And in another place: "It is scarcely fair in Mr. Croll to continue speaking of the wind theory and the gravitation theory of ocean circulation as if they were antagonistic, instead of being not only compatible but mutually complementary—the wind circulation being horizontal, and the thermal vertical." In view of these concessions, it may not be unreasonable to conclude that ocean circulation is due to both causes working together, and that we have not yet sufficient data for finally deciding which produces the greater effect, though, perhaps, the probabilities are in favor of the wind.

S. H. T,

The American Chemical Society.

This is a new organization, lately formed in New York city. The objects of the society are the encouragement and advancement of chemistry in all its branches.

The society consists of members, associates, and honorary members.

Only chemists are eligible as members or honorary members The following are the managers:

President.—John W. Draper.

Vice-Presidents.—J. Lawrence Smith, Frederick A. Genth E. Hilgard, J. W. Mallet, Charles F. Chandler, Henry Morton.

Corresponding Secretary.—George F. Barker.

Recording Secretary.—Isidor Walz.

Treasurer.—W. M. Habirshaw.

Librarian.—P. Casamajor.

Curators.—Edward Sherer, W. H. Nichols, Frederick Hoffmann

Committee on Papers and Publications.—Albert R. Leeds, Herrmann Endemann, Elwyn Waller.

Committee on Nominations.—E. P. Eastwick, M. Alsberg, S. St. John, Charles Frobel, Charles M. Stillwell.

Capsizing of a Yacht.

The magnificent yacht Mohawk, probably the largest pleasure sailing vessel in the world, was recently capsized in New York Harbor, by a sudden squall. The vessel was getting under way under all plain sail, when a heavy gust struck her, throwing her almost on her beam ends. As she righted, another squall threw her back, and her heavy wet canvas pulled her over so that in a short time she filled and sank. Mr. William T. Garner, Vice Commodore of the New York Yacht Club and owner of the vessel, his wife, and three others were drowned. The Mohawk was 150 feet long and of 30 feet beam. Her construction was of the strongest description, and her interior fittings were palatial.

Mr. Garner was one of the largest print cloth manufacturers in the country, owning five large cotton mills at Cohoes, besides many others in various parts of New York State. He employed from 7,000 to 8,000 workmen, and in his cloth-printing factories ran 42 machines, this being dou-

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ble the number used by any other manufacturer in the United States. He was a man of great wealth, a prominent citizen, and one whose loss will be widely and deeply regretted.

Potato Bug Sailors.

The sea coasts in the vicinity of this city and the shores of Long Island Sound are, at the present time, undergoing invasion by countless myriads of potato bugs. Where the insects come from is a mystery. They seem to cling to the floating sea weed and are left therewith on shore by the tide. At Coney Island and other points directly on the ocean the bugs are most numerous, showing that they have been brought hither by sea currents, and by similar means have been swept into Long Island Sound. It seems hardly possible that the insects will now fail to reach the other side of the Atlantic, as they may find transportation on vessels or be carried over in the drifting weed of the Gulf Stream.

Progress of the French Exposition of 1878.

Ninety-four Parisian architects have recently submitted plans for the buildings in which the great French World's Fair of 1878 will be held. For six of these, a prize of $600 each has been awarded, and for an additional six, next in order of merit, the designers have received premiums of $200 each. The project definitely adopted includes a principal palace which will be built on the Champs de Mars, and in the center of which will be the fine art gallery. The latter will be surrounded by the industrial department. France reserves to herself half the space; the remainder will be distributed among foreign nations. The buildings will cover an aggregate of sixty-eight acres, and the total expense of construction is estimated at $7,000,000.

The Spirophorus.

The above is the name of a new device proposed by Mr. Woillez for restoring partially suffocated people. The patient is enclosed in a metal cylinder, so that only his head protrudes; connected with the cylinder is a large bellows holding five or six gallons of air. When this is operated, the air is alternately drawn out and forced into the cylinder, thus causing artificial respiration in the patient. The movements of the chest of the latter can be seen through a pane of glass in the cylinder.

Killing Entomological Specimens.

The Bulletin of the Amiens Linnæan Society describes the following simple device for killing butterflies and other insects, without injuring them, as is often the case when they are held in the hand. A glass tube of sufficient diameter to accommodate the insect is provided, with corks at each end. As soon as a butterfly is captured, one cork being removed, it is gently inserted in the tube, then a wad of tow is pushed in, saturated with a couple of drops of ether. The insect dies instantly, and may be at once removed and pinned.

United States Circuit Court--District of Connecticut.

RULE IN REGARD TO FOREIGN PATENTS.—THOMAS A. WESTON *vs.* WILLIAM H. WHITE *et al.*

An American patent will expire at the same time with the foreign patent granted to the same party or parties, but will not exceed the term of seventeen years.

The date of publication of the foreign patent is to be the date from which to determine the life of an American patent.

The fact that a patent has been issued does not of itself prove the introduction into common use without the necessity of other testimony.

[*E. Wetmore*, for plaintiff.
John S. Beach and *S. W. Kellogg*, for defendant.]

NEW BOOKS AND PUBLICATIONS.

A NEW TREATISE ON STEAM ENGINEERING. By John W. Nystrom, C. E. Philadelphia, Pa.: J. B. Lippincott & Co.

Mr. Nystrom is a thoroughly educated engineer and a competent teacher of his profession: but in this, as in some of his previous works, he falls, we think, into the manifest error of using too many new terms and characters. The object is the laudable one of simplifying his meaning; but the result to the average mind will, we fear, be the reverse. The best of workmen, accustomed for years to his present implements, cannot produce skillful work with strange tools, the manipulation of which he has got to learn before he undertakes a task. The less new terminology introduced into science the better; for the student in any branch has enough to do to become well grounded in principle, without burdening his mind with vocabularies of new languages. Besides, the introduction of new characters and names renders the book useless for reference, save to those who have studied it from the beginning. In other respects, Mr. Nystrom's work is clearly written, and may be profitably studied by engineers and others.

A TREATISE ON THE MECHANICAL THEORY OF HEAT AND ITS APPLICATION TO THE STEAM ENGINE, ETC. By R. S. McCulloch, C. E. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is an elaborate purely mathematical treatise on thermo-dynamics. It requires a thorough knowledge of analytical geometry and the fluxional calculus for its comprehension, and consequently is not a book for the ordinary practical engineer. For advanced students, however, in colleges, it will be found valuable, since it may be used as the continuation of a mathematical course, and in this respect may be advantageously substituted for the works on astronomy and others involving high mathematics, commonly employed for the study of practical application of the abstract reasoning.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BALL VALVE.

Cortland Carlton and John B. Jones, Kalamazoo, Mich.—This invention is intended to take place of the commonly used hinged leather valve, which frequently gets obstructed and out of order; and it consists of a ball valve with metallic seat entering the wooden tubing, being driven by a sharp circumferential flange into the end of the tubing.

IMPROVED STATION INDICATOR.

J. Robinson Balsley, Connellsville, Pa.—As the train, car, or boat leaves a station, a cord is pullod, which turns rollers and brings into view the name of the next station, which operation causes the hammer to strike the bell to call the attention of the passengers to the indicator. As the train, car, or boat approaches the said station, another cord is pulled, which brings the lever into position to be again operated, and also again strikes the bell to warn the passengers that they are approaching the station.

IMPROVED CAR MOVER.

John W. Raynor, Moberly, Mo.—This is for readily moving cars from the main to the side track, or out of the way; and it consists of a block with curved front jaw that takes hold of the outer concave part of the wheel, a pivot dog and block being on the tread of the wheel, and an adjustable gage piece bearing on the flange of the wheel.

IMPROVED SWITCH AND SIGNAL LOCKING DEVICE.

Smith H. Finch, New York city, and Henry Moore, Orange, N. J.—This attachment for switch and signal levers is so constructed that the movement of the detent to release a lever will lock the other levers, or any previously arranged number of them, before the said lever has begun to move. So that the other levers cannot be moved until the first one has been brought back to its place and secured by its detent.

IMPROVED CAR BRAKE.

Peter Hughes, New York city.—This consists of a yoke spanning a friction wheel on each axle of the car, and having a little motion forward and backward, so as to be driven against the wheel from either end of the car. Said yokes are connected together between the axles, and attached at each end of the car with a brake lever rising up in front of the platform, so that it can be worked to apply the power.

IMPROVED SELF-CLOSING HATCHWAY.

Henry Reese, Baltimore, Md.—As ordinarily constructed, the iron hoisting ropes of elevators prevent the use of hinged doors or hatches.—The object of the first part of the invention is therefore to provide hatches adapted for use in such connection; and to this end, rigid arms are attached to the crossbeam of the frame from which the elevator platform is suspended, and cleats are so attached and arranged in the several floor openings of the hatchway that, when the platform goes up, it shall take each hatch or cover with it, and, when it descends, shall leave each in its proper place supported upon said cleats. The second feature of the invention relates to a sliding gate, guard, or railing for each floor opening, the same being arranged to be raised (by hand) when it is desired to transfer goods to or from the platform upon any of the upper floors, and to be automatically released and thus allowed to resume its place when the platform descends.

IMPROVED CANAL LOCK AND DAM.

George W. Parsons, Ceredo, W.Va.—The object of this invention is to enable boats to be passed from one level to another, either in canals or rivers, more quickly and with less labor than by means of the locks heretofore used. To this end, the invention is twofold: It relates, first, to a lock proper; and secondly, to the bulkhead of the lock or dam. For locking purposes the inventor employs vertically acting gates, operated by the pressure of the water in the canal or river. The water is let on and shut off from the pistons which raise and lower the gates, simply by the adjustment of a valve or wickets. It is hence obvious that the labor and time involved in the operation are reduced almost to a minimum. In respect to the chute, the ridge or column of water which forms at the bottom of every fall is broken up by allowing a portion of the water which would otherwise pass over the fall to pass beneath or around it (in one or more separate streams), and enter, or rejoin, the main body at the bottom of the fall. A body of comparatively smooth water will thus be formed to float the boat safely over the brink of the fall.

IMPROVED METHOD OF CASTING CAR WHEELS.

James McAllister, Virginia City, Nev.—This invention is an improvement in the class of car wheels having a soft cast iron hub and a hardened rim or tread. The feature upon which the claim to novelty is based is the form of the meeting portions of the cast iron hub and hardened tread or body of the wheel, whereby they are more firmly united than in other wheels of the class.

IMPROVED TREADLE.

Henry Reese, Baltimore, Md.—This invention relates to an improvement in that class of treadles in which independent foot rests or secondary treadles are employed, upon opposite sides of the fulcrum, for obviating the tiresome strain upon the ankle joint. The invention consists, first, in a raised support with an arc-shaped face upon which the instep of the footstep rests, and upon which arc-shaped face the sole of the shoe becomes the independent treadle, turning upon the curved face as a pivot. It also consists in a pivoted independent treadle, having pendent weights which hold the secondary treadle or foot rest always in a horizontal position.

IMPROVED ROLL FOR RE-WORKING RAILROAD RAILS.

James McCaffrey, Pittsburgh, Pa.—The object of this invention is to economize worn-out steel or iron railroad rails by reducing them to flat bars, in which form they may be conveniently utilized for various purposes. To this end, the invention relates to rolls provided with a series of graduated grooves, through which the rails are passed in succession, being thus gradually reduced to uniform widths.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED VALVE FOR BRASS MUSICAL INSTRUMENTS.

William A. Tischendorf, Leavenworth, Kan.—This invention relates to the cylinder valves of wind instruments to open and close the air passages; and it consists of said cylinders, pivoted on center points adapted to be adjusted from time to time to take up the slack, and being adjusted to spring pressure. The object is to prevent the wear of the cylinders against the sides of the case.

IMPROVED ARTIFICIAL TEETH.

Thomas Williams, Braytonville, North Adams, Mass.—This is a new mode of securing artificial upper front teeth in place in such a way that they will be held firmly in place, and may be readily put in and taken out. It consists in a plate and teeth having grooves or channels along the sides of the outer teeth, and provided with a spring and pad, which rests against the roof of the mouth.

IMPROVED TWINE CUTTER.

William Haddenhorst, Hoboken, N. J.—This is a device for cutting twine or cord as it is used for tying up packages. When a package is to be tied, a sufficient amount of cord is drawn through the device, the package is tied, and the cord is cut off by drawing it across the edge of a blade in the apparatus, leaving the device suspended from the cord, from which it need not be removed until all the cord upon the reel or ball has been used up.

IMPROVED DRUGGISTS' GRADUATED MEASURE.

Edward L. Witte, White Mills, Pa.—This is a druggist's graduate or measuring vessel, having the scale or graduation burned into the glass in black or other color to be clearly and readily distinguishable.

IMPROVED LUBRICATING COMPOUND.

Horace W. Billington, Jersey City, N. J.—This is a lubricating compound consisting of saponified grease or soap, London oil, and paraffin oil. It will keep its state through all grades of weather, as the saponified matter will not melt except when broken or disturbed. It will not congeal or harden on cold iron when in use, nor will it gum or thicken. It is applicable to all kinds of axles.

IMPROVED GLASS BOTTLE MOLD.

Jacob Pease and Abraham Tester, Brooklyn, N. Y.—This consists of the bottom of a glass bottle mold so arranged that the opening of the sides of the mold lets the bottom fall to relieve the bottle from pressure between the bottom and the breast, which in the common molds cracks and breaks the bottles to some extent. The contrivance is such that, when the mold is closed, the bottom is raised up to the proper position for shaping the bottle.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SHEARING CHAIR.

James A. Boals, Dinsmore, Pa.—This invention consists of a horizontally revolving seat and a vertically swinging rack, together with adjusting devices for the same, fixed on a platform and arranged in such manner that the sheep may be so placed on the seat and rack as to be more conveniently supported and handled for shearing.

IMPROVED HARVESTER.

Richard Emerson, Sycamore, Ill., assignor to himself and Horatio H. Mason, of same place.—This is an improvement in the class of harvesters having a binder's table and tilting platform, and a traveling rake arranged to carry the cut grain up to the binder's table. The construction and arrangement of the parts are simple and embody many new devices, which require drawings for their proper explanation.

DITCH-DIGGING AND TILE-LAYING MACHINE.

David T. Lucas, Stockwell, Ind.—This invention relates to a novel construction of ditch-digging and tile-laying machine, designed to effect in one operation the opening of the earth and laying of sections of pipe or tile adjacent to each other, so as to form a continuous under drain. The invention consists mainly in the construction of the placing devices, having a long beam supported in front by a sled adjustably attached to said beam, so as to vary the elevation of the beam and depth of placing devices. The placing device is provided with a chute dam, which the tiles pass consecutively in contact with each other, and occupy a position in the opened channel below, one after the other, in alignment, a supplemental trough being used with the chute to facilitate the inserting of the tiles, and the chute made adjustable to different sized tiles by a spring.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MATTRESS.

John J. Donahoe, New Orleans, La.—The object of this invention is chiefly to effect an economy in the construction of mattresses, particularly in respect to the material of which the covering is composed, and the mode of making up the same. The invention consists in displacing with the cord or binding at one end of the mattress and continuing the ticking around said end so that the portion which covers the top and bottom of the mattress is of one and the same piece. The portion covering the sides is also in one piece, and likewise the binding cord.

IMPROVED WASHING MACRINE.

Thomas Muir, Andes, N. Y.—This invention consists of a couple of conical rollers arranged side by side, and reversed as to their tapers, on a fluted roller, and pressed down upon it by a lever and weight or other suitable means, the said rollers being arranged horrizontally across the middle portion of a tub, so that the clothes can be drawn up from and be delivered back into the tub in working the machine. By the conical form a rubbing action is effected, and by the use of two reversed conical rollers the clothes are made to pass straightly through the rolls.

IMPROVED COFFEE POT.

Willis H. Sherwood, Waco, Tex.—This consists of a receiver for the decoction, fitted in the pot from the top. In the top of the receiver is a dripping cup to hold the coffee or tea, and through which and the receiver a tube extends from the water pot. Up the tube the hot water is forced by the steam, and discharged into the dripper to drip the coffee into the receiver, from which it is drawn for use without passing into the water pot. The receiver is provided with a gage to show the quantity in it, and the water pot has a safety valve to let off the steam when the pressure is too high, the said valve being fitted in the cap of the filling tube.

IMPROVED STOVE PIPE ELBOW.

Alfred Greenleaf, Brooklyn, E. D., N. Y.—This is so constructed that the pipes may be cleaned out, when required, without being taken down, and conveniently examined to see if they need cleaning, and ventilated so that they will not rust if allowed to stay up in summer. It consists in the combination of the collar and the cover with the opening formed in the one part of the elbow, directly opposite the cavity of the other part. The edge of the cover has notches formed in it to receive the screws by which it is secured in place, and which are screwed into the collar, so that by loosening the said screws the cover may be removed.

BATH TUB ATTACHMENT FOR STEAM, HOT AIR, OR VAPOR.

William C. Kidney and Alfred H. Kidney, New York city.—This invention consists in the combination, with an ordinary bath tub, of a casing provided with movable doors or sections, and ventilating doors or openings. By using this attachment, a steam, vapor, or hot air bath may be taken by its owner at his own house and in his own bath tub.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BODY.

Benjamin Rankin, Jeffersonville, O.—This wagon body is so constructed that it will be hald firmly in place, and together. may be readily attached and detached when desired, may be snugly packed for storage, and will allow the rear end boards to be detached without loosening the other parts.

IMPROVED TABLE.

Conrad Schmid, New York city.—This is an improved table for parlors, hotels, and other uses, that may be employed for playing and other purposes, its top being capable of being changed from one side to the other by a simple mechanism. The invention consists in providing the circumferential frame of a table with a swinging end locking leaf and a joint covering molding.

IMPROVED TABLE HINGE.

Frederick H. Cutler, Buffalo, N. Y.—This hinge for table leaves is so constructed as not only to allow the leaf and top to be flush when extended, but mainly to allow the leaf, when down, to hang immediately under the top, and flush with the edge thereof. This allows compactness of form and in packing for shipment, and does away with the usual edge and groove of the leaf and top.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R.H. Allen & Co., N.Y.

Pat'd Graining Stencils—J. J. Callow, Clevel'd, O.

Manufacturers desiring to make, on royalty, a very saleable household and office article, or to buy the patent, address Box 75, Santa Fé, New Mexico.

Barometer Makers—Send circular to Charles Oyston, Little Falls, N. Y.

32 ft. Launch to Sell—R. A. Morgan, Noank, Ct.

Burglar Alarm—Pat. June 20, 1876. Carried in vest pocket: attached quickly to door or window. State Rights for Sale to manufacture. Wm. H. Reiff, Patentee, No. 252 North Fifth St., Philadelphia, Pa.

For Sale Cheap—2½ h.p. Boiler, used 2 mo's, Engine, Shaft, and Propeller. Goss Bro's, Barnstable, Ms.

For Sale—2d hand Machinists' Tools. Send for pamphlet to Steptoe, McFarlan & Co., No. 214 W. 2d Street, Cincinnati, O.

For Sale—2d hand Wood-Working Machinery: Scroll Saw made by Cordesman & Eagan; 3 sided Sash and Moulding Machine, made by J. A. Fay & Co.; Band Saw, same makers; 24 in. Combined Woodworth Planer and Matcher, made by Wetherby, Richardson & Rugg For prices, &c., address Steptoe, McFarlan & Co., No. 214 Second St., Cincinnati, O.

Any Parties desiring a Salesman to Sell or Introduce an article of merit in the U. S. or Canada, will please address Experience, Box 282, Cuba, Alleghany County, N. Y.

Wanted—Situation by Mechanical Supt. Iron Machine Work, general or special. References furnished. Address P. O. Box, 383. Chicopee, Mass.

Celebrated John Scott Scroll and Jig Saws made to order, of Jessup's superior cast steel, by I. Roberts, 108 Hester Street, New York. Send for circular.

Split-Pulleys and Split-Collars of same price, strength, and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N.J. & C. 27, Mchy. Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution —Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

See Boult's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills Pittsburgh, Pa., for lithograph, &c.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality.—Whitinsville Spinning Ring Co., Whitinsville, Mass.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

J. P. McD.'s query as to the velocity of thought is too metaphysical for our columns.—D. P. D. will find directions for transferring engravings to wood on p. 138, vol. 30. For transferring them to glass, see p. 123, vol. 30.—P. R. L. will find directions for dissolving mica on p. 241, vol. 32.—J. B. Jr., can preserve fruit by following the directions on p. 169, vol. 33 —L, L. F. should use the recipe given on p. 360, vol. 34, for renovating clothing.—A. P. W. will find a description of malleable glass on p. 402, vol. 32.

(1) E. S. B. asks: Will a projectile thrown upward in the air fall with greater, less, or the same velocity as that with which it ascended? A. The terminal velocity will be less than the initial. 2. What is the use of having the rifles of a gun barrel twisted? A. To give the bullet a rotary motion.

(2) J. B. M. asks: 1. Is it more injurious to track, bridges, and rolling stock to run loaded freight trains at the speed of from 30 to 40 miles per hour, than from 10 to 20 miles per hour? A. Yes. 2. Will it require more fuel to haul a loaded freight train 100 miles at the rate of from 30 to 40 miles per hour than from 10 to 20 miles per hour, all other things being equal? A. It is the general opinion of railroad men that the slower speed is the more economical, but there have been some recent experiments which point to the opposite conclusion.

(3) M. W. asks: What is the weight of a cubic foot of solid ice? A. About 57⅕ lbs.

(4) T. H. S. asks: Why do the dots on a telescope's joints have to be placed in a straight line? A. Because the tube is the straightest in this position.

How can I make sulpho-cyanide of mercury? A. Take the commercial sulpho-cyanide of potassium in ammonium, dissolve in water, and precipitate with bichloride of mercury; this precipitate is washed in several changes of water to free it from the chloride.

(5) A. S. asks: How can one reduce his weight without injury to health? A. Mr. Banting, an author on this subject, succeeded in reducing his weight some scores of lbs. by leaving off eating plain bread, potatoes, butter, fat meat, pastry, sweets, salmon, pork, and veal; and restricting his diet to fish, lean beef and mutton, and toasted bread or crackers, and fruit. He drank nothing with milk or sugar in it, nor any wine but claret, and no beer.

(6) E. L. G. asks: 1. Can the telephone arrangement, as noticed in SCIENTIFIC AMERICAN of August 1, 1874, be operated without a battery? It is for a distance not exceeding 100 feet. A. No. 2. If not, is there any cheap reliable battery, easily understood by the average mechanic, not needing attention very often? A. The sulphate of copper battery is one of the best.

(7) J. F. A.—To find the diameter of a round opening having the same area as a rectangular one, divide the area by 0·7854, and take the square root of the quotient. Hard cast iron will probably be a good material for a nozzle.

(8) L. C. M. asks: Will a vertical steam boiler 30 inches high by 16 inches diameter, with 12 upright flues, 1¾ inches in diameter, running the length of boiler, set on the lower half of a common coal stove, be of sufficient capacity to warm a house by hot water, the house containing 4 rooms, each 16 feet square by 9 feet high? A. If you have a strong draft, and a good arrangement of heating pipes, we think your boiler may answer.

(9) B. K. asks: Will common coach varnish do to varnish a poplar boat that is not painted? A. The best transparent coach varnish will probably answer very well.

(10) A. O. Y.—If you have written respectful letters to the Secretary of the Navy, as to entering the Naval Academy, and have received no reply, you might very properly address the member of Congress from your district in regard to the matter.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Medicinal Use of Chalk. By T. C. H.
On a Grease Soap. By B. C.
On Liquid Glue. By D. W. P. A.

Also inquiries and answers from the following:

T. P.—J. H. N.—G. M.—G. S.—W. H.—S. P. F. F.—C. F.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells Japanese lacquered ware? Who makes the best locomotive engines? Whose is the best achromatic telescope? Why do not wholesale druggists advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 4, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alarm, burglar, J. Allen 179,391
Amalgamating apparatus, T. W. Irving 179,562
Animal feed bag, T. Miller 179,590
Animal obstetric instrument, W. Dulin 179,538
Annunciator, electric, N. A. Buell 179,446
Bale tie, R. C. Ludlow 179,578
Bale tie, B. A. Ramsey 179,604
Barb former, J. A. Swan 179,625
Barrel, tumbling, O. D. Hunter 179,455
Bath, compressed air, D. Kelly 179,414
Bed bottom spring, J. Rouse 179,613
Bedstead, wardrobe, S. S. Burr 179,513
Bell-ringing apparatus, J. W. Coffey 179,524
Bells, spring hammer for, A. B. Tanner 179,493
Belt-tightening device, G. W. Parrish 179,487
Beverages, fountain for, J. Matthews 179,583
Bill file, P. C. Clarke 179,447
Billiard table leveler, E. H. L. Swindler 179,626
Bobbin, Blauvelt & Mortimer 179,510
Boiler, locomotive, C. A. Clark 179,318
Boiler plates, shearing, E. Fisher (r) 7,201
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9,361.—CASKET SCREW PLATE.—R. H. Burr, West Meriden, Conn.
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9,363.—EAVES TROUGH.—D. M. Cummings, Enfield, N.H.
9,364.—FOUNTAINS.—J. W. Fiske, New York city.
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9,366.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,367 to 9,370.—CENTER PIECE.—S. Kellett, San Francisco, Cal.
9,371 to 9,373.—CARPETS.—J. G. C. Libert, Paris, France
9,374.—DROP HANDLES.—W. R. McComas, Cincinnati, O
9,375, 9,376.—CARPETS.—D. McNair, Boston, Mass.
9,377 to 9,381.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
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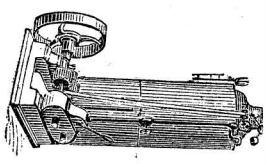

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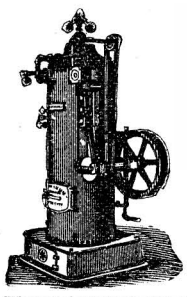

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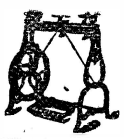

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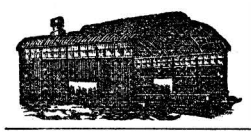

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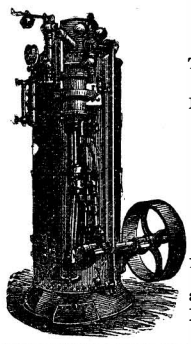

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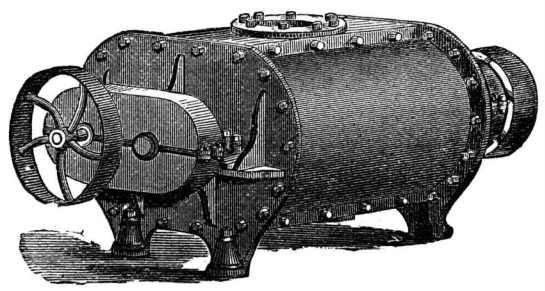

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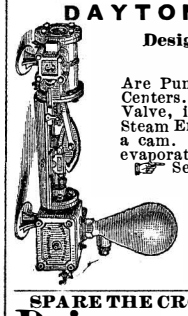

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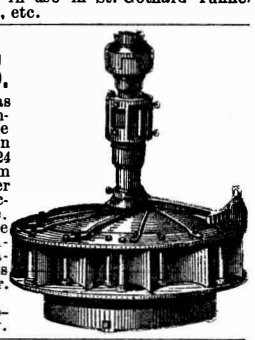

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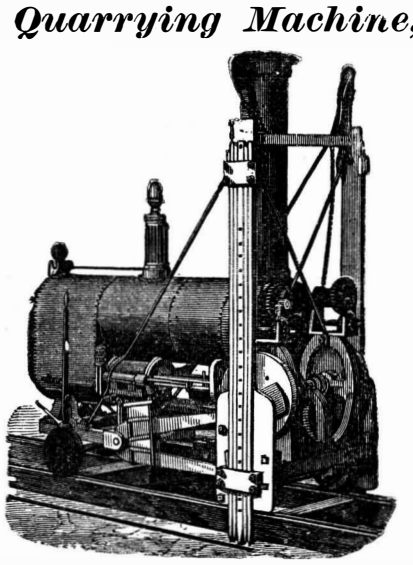

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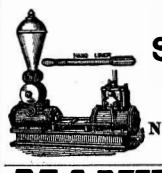

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